MACHINE DESIGN

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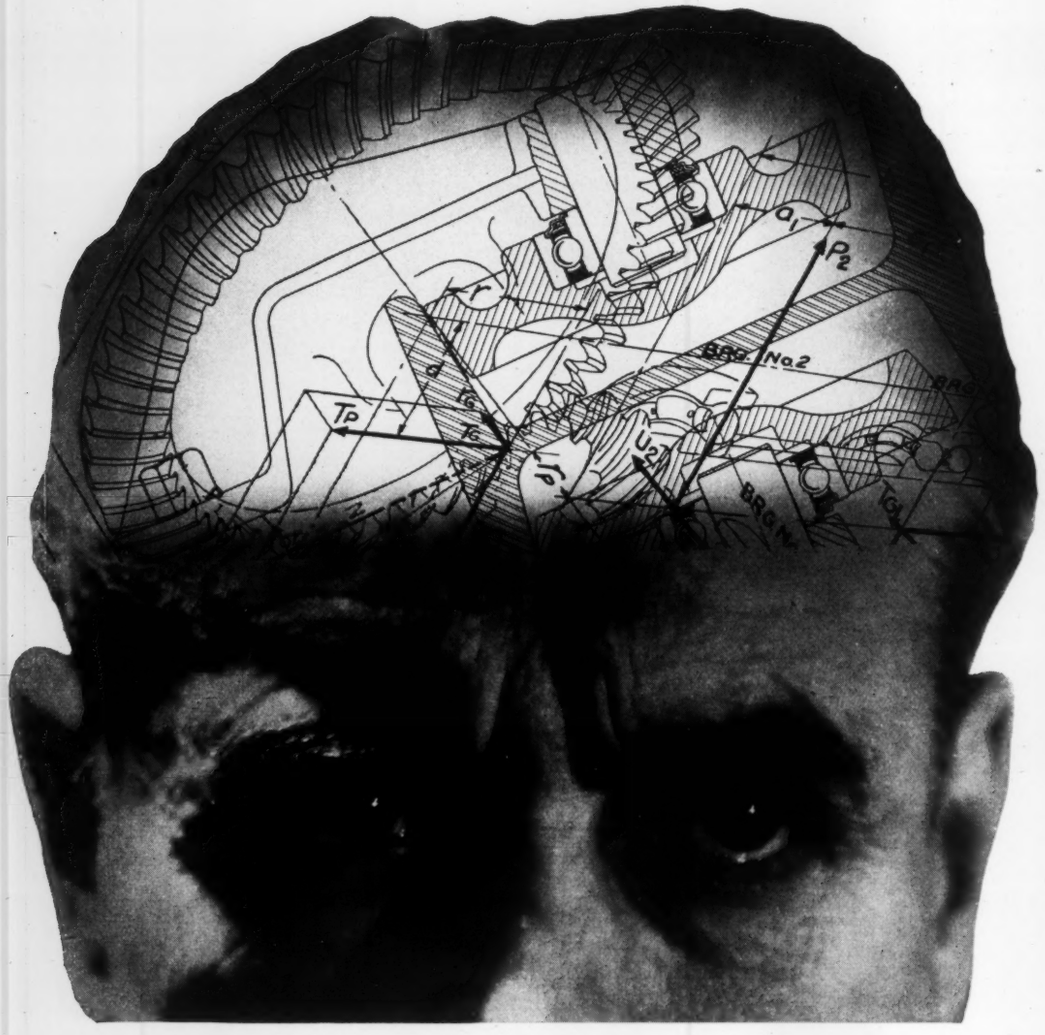

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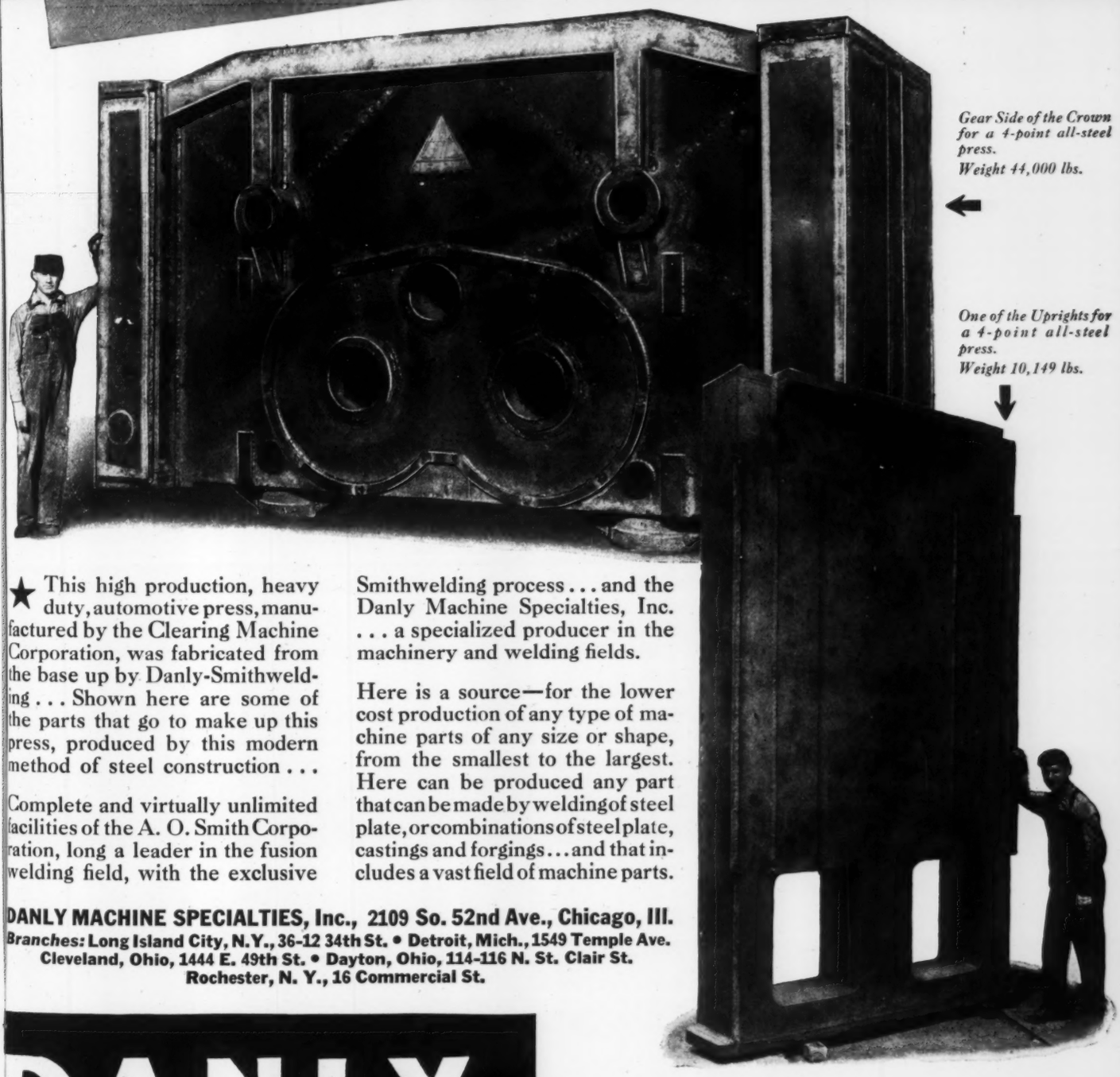

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CALENDAR OF MEETINGS AND EXPOSITIONS

Feb. 17-22—

American Ceramic society.

Exposition and annual meeting to be held at Hotel Statler, Buffalo, N. Y. Ross C. Purdy, 2525 North High street, Columbus, O., is secretary of the American Ceramic society.

Feb. 18-21—

Technical Association of the Pulp and Paper Industry.

Exposition and annual meeting at the Waldorf-Astoria hotel, New York. R. G. Macdonald, 1 East Forty-second street, New York, is secretary of the technical association.

Feb. 18-21—

National Association of Coin Operated Machine Manufacturers.

Fifth annual coin machine exposition and annual meeting to be held at Hotel Sherman, Chicago, C. S. Darling, 120 South LaSalle street, Chicago, is secretary of the association.

Feb. 18-21—

American Institute of Mining and Metallurgical Engineers.

The 144th meeting of the society to be held at Commodore hotel, New York, will include technical papers on "The Properties and Uses of Tin," by D. J. MacNaughton; "Physical and Casting Properties of Nickel Silvers," by T. E. Kihlgren, N. B. Pilling and E. M. Wise; and "Metallurgical Effects Produced in Steel by Fusion Welding," by A. B. Kinzel. A. B. Parsons, 29 West Thirty-ninth street, New York, is secretary of the institute.

March 3-10—

Leipzig Trade Fair.

International exposition to be held at Leipzig, Germany. Information may be obtained from Leipzig Trade Fair Inc., 10 East Fortieth street, New York.

March 5-8—

Packaging Exposition and Conference.

The fifth annual exposition and concurrent conferences and clinics on packaging, packing and shipping, sponsored by American Management association, is to be held at the Palmer House, Chicago. Management offices of the exposition are located at 232 Madison avenue, New York city.

March 12-14—

American Railway Engineering association.

Annual meeting and exposition to be held at the Palmer House, Chicago. E. H. Fritch, 59 East Van Buren street, Chicago, is secretary of the association.

April 22-26—

American Chemical society.

Semi-annual meeting to be held at New York. Dr. Charles L. Parsons, 728 Mills building, Washington, is secretary of the chemical society.

April 22-26—

Knitting Arts Exposition.

Thirty-first annual exposition of machinery and products to be held at Commercial museum, Philadelphia. The exhibit is sponsored by National Association of Hosiery Manufacturers, Commercial museum, Philadelphia.

May 20-23—

National Association of Purchasing Agents

Annual meeting and information show to be held at New York. G. A. Renard, 11 Park place, New York, is secretary of the association.

June 24-28—

American Institute of Electrical Engineers

Semiannual meeting to be held at Cornell University, Ithaca, N. Y. H. H. Henline, 33 West Thirty-ninth street, New York, is secretary of the institute.

June 24-28—

American Society for Testing Materials

Thirty-eighth annual meeting and exhibit of testing apparatus and related equipment will be held at Book-Cadillac hotel, Detroit. C. L. Warwick, 260 South Broad street, Philadelphia, is secretary of the society.

MACHINE DESIGN
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February, 1935 Vol. 7—No. 2

Designing for Appearance

Part I

By Harold L. Van Doren
Van Doren & Rideout, Toledo, O.

DESIGNING for appearance cannot be done successfully without careful consideration of fundamental principles such as presented by Mr. Van Doren. Three-dimensional work and actual applications of the principles to machines will be covered in later issues.

IN APPROACHING any problem of industrial design the artist-designer seeks out the logic inherent in the product or machine he is treating before he ever touches pencil to paper. What is its *function?* Where and how will it be used? What will its surroundings be? Is there anything he can do to make it any more accessible, any more convenient for the operator? There is no use, he knows, in trying to make a planer or a milling machine look like anything but a planer or a milling machine. But it should look like the best planer or milling machine ever built! It should be the aristocrat of all planers or milling machines.

The engineer says, "But it looks like a milling machine now. And it is by all odds the best machine built today to do its particular job. It's going in a factory anyway, and who will care how it looks? Better leave it alone."

I beg to differ. There are certain isolated mechanical forms—bearings springs, gears, propellers, etc.—which the artist-designer has no business monkeying with. They are perfect in themselves in that they perform their function admirably and have a mechanical perfection of finish which cannot be excelled. But I have yet to see a machine assembled from many parts which could not be improved in its *unity.* The industrial designer knows ways of leading the eye from place to place, of simplifying and emphasizing, which make it *seem* to fulfill its function to the utmost.

The new art of industrial design will come completely into its own only when the manufacturer and his staff comprehend the inexorable logic behind the artist-designer's procedure. Just so long as the engineer clings to the belief that the industrial designer depends largely upon the caprice of the moment, or upon some curious mumbo-jumbo understood by industrial designers alone, he will naturally resist any outsider's meddling in the complicated problems that arise in the creation of any machine.

Whenever antagonism exists, however, it can usually be traced either to misunderstanding of the way the industrial designer works, or mistrust of his training and background. With the idea of helping to dispel the last vestiges of such antagonism, the editors of MACHINE DESIGN have asked me to

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set down a few of the principles by which the industrial designer works.

These principles are the alphabet of the designer. They are his five-finger exercises. And they apply in some form to all the other arts: Music, poetry, architecture, sculpture, the dance.

I do not wish to cajole anyone into the belief that he can read these articles and thereupon produce a sound and well-integrated piece of design. But I sincerely believe that the application of some of these fundamentals to any design-for-appearance problem will minimize the chances of clumsy and inartistic results. For example, the engineer who, in drawing the housing for a machine, will try to approach the problem with some of these principles in mind, cannot help but find them of benefit when confronted by some of the vexing problems that invariably arise. And the manufacturer who feels that the time is not ripe for the expense of consulting design service, and who yet feels that his product needs more "eye appeal," may find here some clue which will be, if nothing more, a temporary helping hand out of his difficulties.

If these principles seem in themselves rather like ABC, the reader is hereby warned that their proper application is not so easy. So many barriers may be raised by the "orneryness" of the machine itself, or the difficulties of its manufacture, that one sometimes gives up in despair and violates all the rules, or else loses sight of them completely in the devious byways into which their actual application leads. The successful design is that which has retained the maximum of "visual rightness" with the minimum sacrifice of efficiency and production practicability.

The principles I refer to are few in number, but large in import: Rhythm, Proportion, Balance, Unity. They will not be discussed in that exact order, nor always separately. Balance is a strong factor in obtaining Proportion; Unity presupposes the correct interrelation of the other three. We will start, rather, with simple elements, gradually progressing to more complex problems.

Let us begin with the simplest form of notation we can make, a single dot. Here it is:

●

You will admit that I have chosen the most impersonal form possible. As design it means nothing; it is merely an isolated phenomenon, made with the point of a pen or pencil, having no artistic significance. It is, so to speak, a graphic representation of the geometrician's "point in space." Before this tiny dot can have artistic significance it must be placed in juxtaposition with other dots, lines or marks. Once this has been done, we begin to have the materials for design.

Very well, let us take two dots, thus:

● ●

Still pretty slim pickings. If they remain close enough together they have possibilities. (Set them apart and they are naught). But still something is lacking. The eye moves from one to the other, rests nowhere. Something is needed to tie them together Happy thought: We will add another dot, so:

● ● ●

Now, gentlemen, we have something! We have made real progress. Believe it or not, we have the necessary tools for design. These three dots are far more fundamental than you may think. For one thing, we have acquired balance. The eye can rest more easily on three objects, even if they are all alike, than it can on two. It seeks out the dot in the center, and rests gratefully there, allowing its two companions to take a secondary place in our attention. It could be given vastly increased interest by changing the position of the dots, or by altering the size of some of them. But we are getting ahead of ourselves. For the time being let us deal with dots of equal size placed in a row. We will skip four dots, because we would be no better off than with two. The eye would wander aimlessly among them, never come to rest, and soon move on to more interesting visual phenomena. Let us try five:

● ● ● ● ●

Here again is an interesting arrangement. The central dot becomes the center of attention, flanked by a balanced number on either side. But—danger signal! We are running full steam ahead into one of the worst of all pitfalls, *monotony*. We cannot go much farther and still have good material for design. Six dots would be worse than four, seven is practically the limit for sustaining interest, and even then should not be attempted except by an experienced designer in conjunction with other elements which he knows to be of interest. More than seven could not possibly be recognized by the human eye as a balanced unit, for you would have to stop and count to determine whether it contained an odd or an even number. We are back where we started, with one or with two. Nothing to hold the attention. Monotony.

Very well, let us deliberately set down a monotonous number, a number that cannot instantly be counted by the human eye, say nine. Let us see what we can do with them.

● ● ● ● ● ● ● ● ●

Nine identical dots in a row: Raw material. A single drum-beat would mean nothing; it

would be the audible equivalent of one dot, just an isolated phenomenon. But an evenly spaced succession of drums-beats, the steady, monotonous throb of the tom-tom, contains the raw material of Rhythm. It is unorganized, unassimilated. It needs conscious manipulation to give it interest, pattern. Fortunately, a sense of rhythm is common to almost every human being. It is the lowest common denominator of music. Whoever responds to the simple rhythms of music can develop a feeling for the simple rhythms of design.

But to return to our dots. A series of dots prolonged beyond the capacity of the eye to count at a glance is obviously monotonous. It is the ticking of a clock, the steady dripping of water from the tap into the sink. It is so monotonous that it soon fails to hold our attention and we do not even notice it—unless it happens to "get on our nerves." The human mind rejects monotony, craves variety. The simplest way to obtain variety, still using the same dots for elements, would be to arrange them in groups with spaces between:

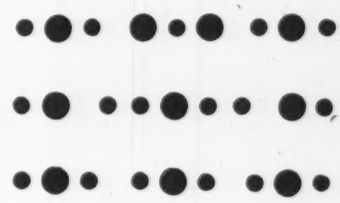
The spaces, or "rests" as they would be in music, give us our first real sense of rhythmic arrangement. We have broken the monotonous spell cast by repetition, and obtained the beginnings of pattern. Other groupings can be made, further increasing the interest, such as:

But to return for a moment to the original nine dots. In what other ways can we vary them? By changing their *size* and their *position*. Spacing them evenly, as at first, we can enlarge every other one, thus:

By so doing we have given *accent* to the monotonous succession with which we began. It is the rhythm of a military march—ONE, two, THREE, four. A better arrangement, pictorially, would be the equivalent of the waltz, with an extra beat at the beginning and with part of the last bar amputated:

Our waltz is far more interesting than the march, because the three large dots make for better balance than four. You can get the feel of these rhythms by beating them out on a drum, or with your knuckles on the arm of your chair, using a light tap for the small dots and a heavier one for the large dots, and prove to yourself that rests and accents are more exciting than monotony.

But let us get back to our dots. In accenting them with larger dots we have still preserved the even spacing of the first row. Now if we will combine accents with spaces, or "rests," we can produce a whole new series of effects, much more varied than either method taken separately can produce. Here are a few examples:



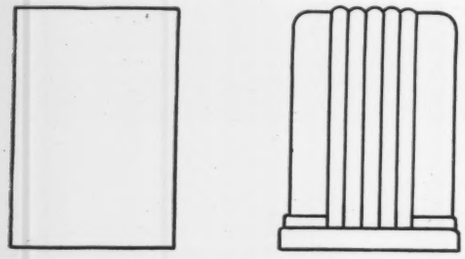
Yet this is only the beginning of the possibilities inherent in a simple graphic form. Up to now we have confined ourselves entirely to dots arranged in a row, and have used only one weight of accent. If we were to spread out in other directions, introduce other accents, and group the spots in areas, we could soon fill many pages, for the combinations are inexhaustible. This might be instructive if we were to study pattern as applied, let us say, to textile design. But it is not often that we have occasion, in industrial design, to apply a pattern all over a two-dimensional area.

The "Saga of the Dots" illustrates a number of fundamentals. We chose this simple shape because it is easily grasped and conserves valuable illustrative space. We have let the dot stand as a *symbol* for any line or shape or form with which we may be called upon to deal. It might for instance represent the bosses on the casting of a drill press head, the slats on a sled, the decorative ribbing on a radio, the dial openings on an instrument board, any problem where you have a repetition of like or similar shapes. Avoid monotonous repetition. If possible, combine the middle two out of four, thereby giving variety and accent to the design. Utilize spacing, or "rests" to concentrate attention, and create rhythm.

Perhaps an illustration is in order. Let us say we have the housing or shell of some product before us—a check register, an automobile heater, a computing machine. It is a box-like stamping, and needs relief. We decide to embellish it with ribs.

Now ribs have been overdone in modern design, but they are simple to machine in the die, and die cost is usually a factor. They are easy to buff and polish. They are dignified, and, if in a contrasting finish, may add snap and distinction. Since we are not hampered here by necessity, we will choose an odd number of ribs, for reasons stated in the foregoing, say five. The end of the housing is represented by the follow-

ing rectangle, and an agreeable placement of five ribs shown beside it.



The number of rib shapes you can use is endless. They may not be ribs at all, but flutes. Or they may take the form of serrations, or flattened triangles. You may wish to combine different forms, or accent them in different ways, or vary their width.

The thing you must guard against is using them *at all* if they are not necessary. Perhaps the cover should really be plain. If, and only if, the ribs cannot be subtracted without injury, they should remain; they have then ceased to be mere embellishment and have become a necessary element in the design. Strive always for simplicity, for therein lies the greatest beauty. "When in doubt, leave it out" would be a good rule to follow.

So far we have dealt with small units, dots, which we have used as symbols for other shapes and forms. It is time we attempted the more advanced subject of space division. In industrial design we are dealing with objects in three dimensions, in the "round." A washing machine, a furnace, a vacuum cleaner will be looked at from every conceivable angle, and never from the identical spot twice.

But before we can discuss the complicated problems of design in three dimensions, we must understand some of the principles involved in the pleasing division of two-dimensional spaces. It involves the questions of Balance, Proportion, Unity. Rhythm also, for there can be rhythm in areas as well as in lines.

What do we mean when we say that a human body, a skyscraper, a dining room table, is well-proportioned? Simply that every member is in harmonious relationship with every other member. If legs are too short in comparison with trunk, we instinctively note the variation from the ideal figure. If the top of a table is a pleasing rectangle, and the supporting members are neither too thin nor too ponderous, it is good in proportion.

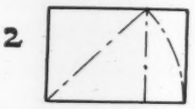
But what is a pleasing rectangle? Fortunately there are mechanical aids to help us. They are of value insofar as they help to train the eye, and also as a check on our work as we go along. For in the last analysis the eye, properly trained, is the court of last resort in all matters of design.

First let us consider a simple square, on which we are going to base the rectangle. Here it is:

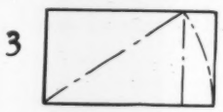
As a basis for a design it is not among the most useful. It has an air of finality, but it is static. It does not invite the eye to roam. It does not suggest movement, which every design, even that of a furnace, should have. (We refer to the "movement" of its interrelated form elements.) If you subdivide the square symmetrically you obtain other static shapes.

Let us add slightly to this square, in one direction, so that its breadth is a little more than its height.

Technically this a rectangle. But it is *not* a pleasing one. Why? Because it is neither fish nor fowl—too close to a square to give the feeling of finality communicated by that shape, not enough of a rectangle to subdivide interestingly. No rectangle will be really interesting as an abstract shape until its width equals at least the diagonal of the square on which it is based, as:

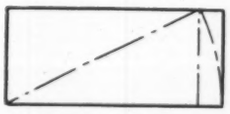


Another pleasing rectangular shape can be produced in similar fashion from this, letting the width of the new rectangle equal the diagonal of the preceding one:



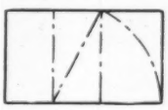
When this procedure is carried one step further, taking the diagonal of rectangle No. 3 for width, we have a shape composed of two contiguous squares of the size with which we started. You will have to take my word for it that this shape is not inherently as good as either No. 2 or No. 3. It could be shown, but the demonstration would involve too many steps. It does not subdivide as readily as the others:

But still another step, based as before on the last rectangle. No. 4, produces a longish shape which is again replete with possibilities.



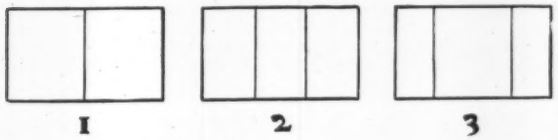
You will notice in this series developed from a square by successive diagonals, (counting the square as No. 1), that the two shapes which offer the best possibilities for interesting subdivision are Nos. 3 and 5. (Again that rule of three and five.) Note also that step No. 4 produced a rectangle composed of two identical squares, and is not a particularly pleasing shape, an exact analogy to the two dots (or four) discussed in the foregoing.

Perhaps the most completely satisfying of all rectangular shapes is the famous "Golden Rectangle" of Leonardo da Vinci. It can be produced by bisecting the square, drawing the diagonal of half the square, and producing this along the bottom line as before:

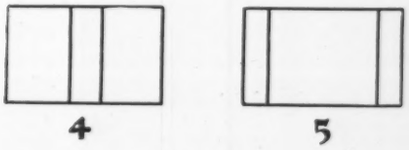


If the main enclosing shape of a piece of industrial design could be fitted into this shape, and the subdivisions within the shape agreeably made, our problem, at least in its two-dimensional aspect, would be quickly solved. This remarkable shape is susceptible to artistic subdivision in almost unlimited ways. Those who wish to explore its possibilities would do well to secure Jay Hambidge's *Elements of Dynamic Symmetry,* where they will find the vast ramifications of this and other simple geometric forms thoroughly analyzed and developed.

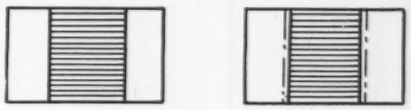
But we must forego such advanced speculations and confine ourselves to simple diagrams which can be used as rules of thumb. Let us take one of the shapes we have developed, the so-called "Golden Rectangle." We know better than to divide it (No. 1, in the next illustration) into two parts. (Remember the dots). Three equal parts is better (No. 2) but, as with the three equally spaced dots, it leaves much to be desired. It is better, of course, to make shapes alike than *almost* alike. But it is still better to make them distinctly *un*like. Therefore we will widen the central portion considerably so that the two resulting end areas are quite different from the center area (No. 3):



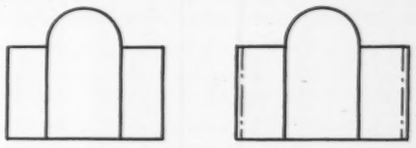
The exact location of the lines necessary to divide the rectangle into the most agreeable proportions could be demonstrated with instruments, but it is time that we cultivated the habit of letting the eye dictate the best balance of the elements. We would not, for instance, divide it in either of the following ways, that is, if the entire rectangle were of the same tone value (i.e., all gray, or all tan, etc.):



No. 3 of the last series is surely superior to any of the others if we are trying to obtain formal balance and agreeable proportion. (The question of informal balance, which will be touched upon later, is not as frequent a problem in industrial work). But, although No. 3 might be perfect if we were dealing only with areas of the same tone value, we might want the central portion darker. In this case the central area might overbalance the lighter flanking wings (left, below) and we might have to make an adjustment, by narrowing it, to secure the correct visual balance (right, below):



The same might be true if we modified the whole shape by adding more *area* to the central portion (left, below). This might demand a slight enlargement of the wings to compensate (right, below):



The texture of the finish might also have a bearing on our decision about the exact proportions which would be best for the center area. If the wings were bright chrome and the center Butler finish, the bright metal would be overpowering, and more space should be given to the satin finish. These are refinements which take judgment and experience to manipulate. But as the eye gradually becomes trained, they seem to follow a certain inexorable visual logic.

These are merely a few of the simple ways in which we might find it possible to manipulate a plain rectangular shape. I have not attempted to apply them to any specific problem, and shall not until a later date. But I hope that I have suggested a method of approach appealing to anyone whose mind is cast in a logical mold.

SCANNING THE FIELD FOR IDEAS

CONTROLLING MACHINES BY COLOR

MACHINE control by color—another step in the simplification of machinery operation. At the British machine tool exposition at Olympia last November the idea, adapted to machine tools, created considerable interest and comment. The use of colors to designate feeds, speeds, etc. eliminates instruction plates which often contain masses of figures and letters that confuse the operator. Because color is a universal language, the system has proved particularly effective where native labor consisting of several nationalities is employed.

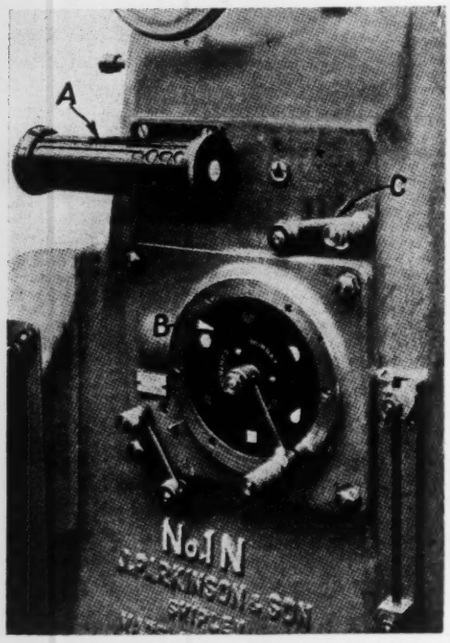


Fig. 1—A color control drum guides the operator in selecting machine settings

An English mechanical engineer, Guy L. Murray, conceived the idea of using the color control scheme. Its early application was confined to gages colored in accordance with the work-check. Simplicity of the system and the excellent results obtained in practice augured its wider utility. It was, therefore, adopted for machine tools.

Among the first to see the advantage of the color control system was J. Parkinson & Co. Ltd., Shipley, England, according to a recent article published in *The Automobile Engineer* from which the following is abstracted. In *Fig.* 1 is shown one of this company's milling machines on which the device has been employed. Color control drum *A* replaces the original tabular plate with its 474 figures that were required for determining the correct cutting speed, based on the diameter of the cutters. The end plate at the left of the drum is set to the cutter diameter, while the end plate at the right selects the correct color combination for any required cutting speed. To determine the spindle speeds the dial *B* which originally bore figures, now is arranged with color symbols that coincide with the colors revealed on drum *A*. When the operator manipulates the color control drum there appear the colors to which each control wheel or handle should be set.

Because each color has a characteristic shape, mal-operation by an operator who may be color-blind is prevented. Inasmuch as the system possesses the two distinctive features, color and shape, it is claimed that the device is entirely foolproof. World patents have been taken out.

EMPLOYING PACKAGED GREASE

HERE is an idea that shows what can be done to improve every-day equipment that may have labored under a bad reputation. The grease gun and its companion, grease, have always been the antithesis of cleanliness. But along comes Standard Oil with grease packed in cartridges and a new type of gun to "shoot" it, thereby removing the curse.

In the old type of grease gun, filled laborious-

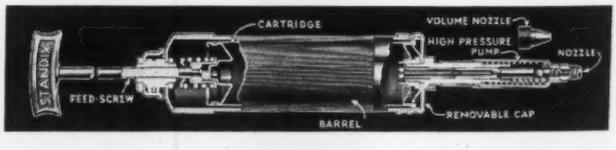


Fig. 2—Grease packed in cartridges for this lubrication gun aids cleanliness, extends utility

ly and messily from cans and drums, formation of air pockets and inclusion of dirt was almost unavoidable. To fill the new type of device, *Fig.* 2, the operator merely slips in a factory-loaded cartridge of the desired lubricant. After using the required amount from any cartridge he can remove it from the gun and substitute another.

Each cartridge can be used again later, and repeatedly until it is empty. The gun works under a pressure of over 5000 pounds per square inch. A variety of nozzles can be attached. Cartridges have a sliding bottom which acts as a plunger to feed lubricant into a high-compression chamber in the nose of the gun.

DIE CASTING COMBINES PARTS

EVERY designer is looking for short cuts to more economical production. Sometimes die casting is the answer; it was, in the case of the parts of an upper engine lubricator, *Fig.* 3. Originally the unit was made up of the several

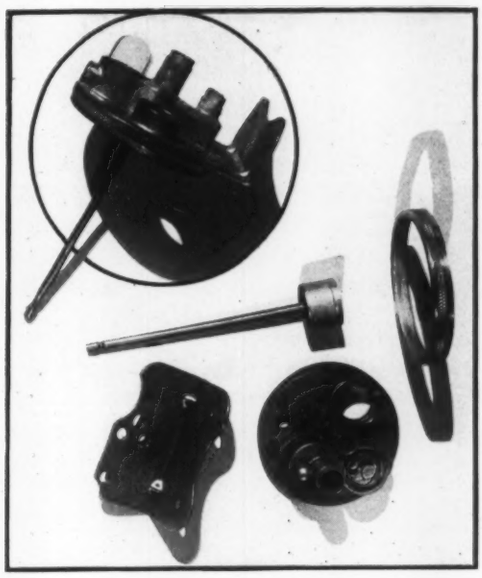


Fig. 3—Three parts now are produced as one unit by die casting

parts shown. Then redesign produced the assembly shown in the circle.

The new design comprises two zinc alloy die castings, one of which is a thermostatic unit, assembled with the cover by a simple press fit. Purpose of the lubricator is to conduct oil into the motor head at a steady rate to lubricate the valves and cylinders. Manufacturer is the Marvel Products Co.

WILL REAR-ENGINED CAR STAY?

ANOTHER prediction comes true! These columns have from time to time reported developments that foreshadowed the building. on a production schedule, of a rear-engined, streamlined auto in this country. Now it is a reality, with William B. Stout its designer. To visualize the exterior appearance of the car, *Fig.* 4, all previous conceptions of an automobile must be discarded. There is no dividing line between body and chassis, no fenders and exterior fitted lamps. The entire beetle-shaped structure is

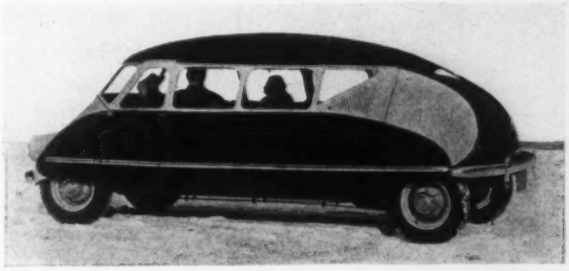


Fig. 4—Stout's Scarab is harbinger of modern rear-engined automobile in this country

built on a frame of alloy steel tube hoops, giving a high safety-strength ratio. In this structural design Stout has employed his experience in building all-metal airplanes.

The engine, utilizing the space occupied by the usual trunk rack, is a standard V-eight of 100 horsepower which drives through a selective gear mechanism to the rear axle. Support for the body is materially above its center of gravity. Consequently the car tends to pendulum and "bank" on turns. This method of support eliminates all tendency of the car to roll, even on sharp corners. Side stability plus the ease of sensitive spring suspension obviates quick road shocks.

One of the striking features of this new car is its roominess. Although the roof is at the usual height there are five inches more headroom inside the car than in the conventional type. The windshield is almost directly over the front wheels. The driver's seat is adjustable in all directions. Usual seating accommodations consist of two removable chairs, and a wide couch rear seat in addition to the driver's seat. A folding table is fitted into the wall of the car.

DETECTING FISSURES ELECTRICALLY

TRANSVERSE fissures and other rail defects in railroad track now are detected electrically. The idea, developed by Sperry Products Inc., is novel and has wide application outside the railroad field. Known as pre-energization, or the third brush system, the method consists of delivering current to the rails through the auxiliary brushes of a separate circuit in advance of the regular main brushes of the test car which moves over the rails the same as a train but at much slower speed. When a defect has been located a painting device auto-

matically leaves a white spot on the "sick" rail.

The late Elmer Sperry conceived this development, and research since has been carried on in the Sperry laboratory. Experiments with "difficult" fissures disclosed that each face of a transverse fissure comprises a magnetic pole, produced by the earth's magnetic field. Also, when heavy current is passed through the rail the fissure faces acquire a polarity due to electrical energization. It was found that fissures are detected easily when their initial polarity coincides with the polarity of electrical energization, but if natural polarity opposes the energizing current, the normal flux distortion is either eliminated or greatly reduced, making detection difficult if not impossible. By pre-energizing the rail by means of a third brush, the fissure faces are given the correct polarity and complete detection results.

ARC WELDING LIGHT SECTIONS

WELDING continues to uncover new applications. One of the latest developments is the welding of tantalum sheets 0.005-inch thick. Fansteel Products Inc. has perfected the method, employing Lincoln Electric Co. equipment. Because tantalum, a rare metallic element, is worth $50 a pound and possesses certain unusual characteristics a special technique is imperative.

The process consists of first forming a straight angle flange on all edges of the sheets to be arc

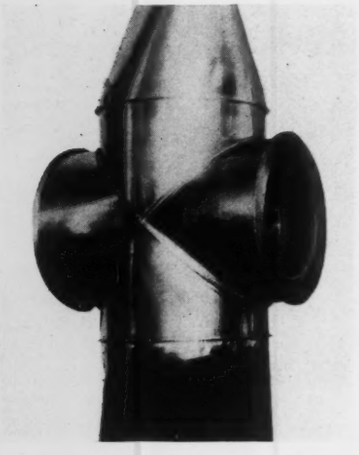


Fig. 5—By a technique which involves immersion of the parts in carbon tetrachloride, tantalum sheets 0.005-inch thick are arc welded

welded. These flanges then are fitted together and tack welded in several places. Subsequently the work is immersed in a tank filled with carbon tetrachloride so that the edge to be welded is approximately ¼-inch below the surface of the liquid. This technique is particularly effective because of the thinness of the stock and the necessity for strict localization of heat.

Welding the edges of the flanges together must be done quickly since holding the arc in one spot or striking it more than once in the same place is likely to result in brittle welds. This and the work being done in the welding of light sections such as those found in many stampings are noteworthy advancements.

MECHANISM EXPEDITES FREEZING

A REVOLVING hollow spindle equipped with a spray head is reciprocated vertically to provide an essential mechanical detail of a new quick-freezing process. In designing the mech-

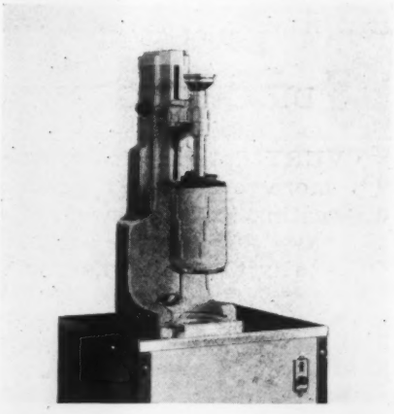


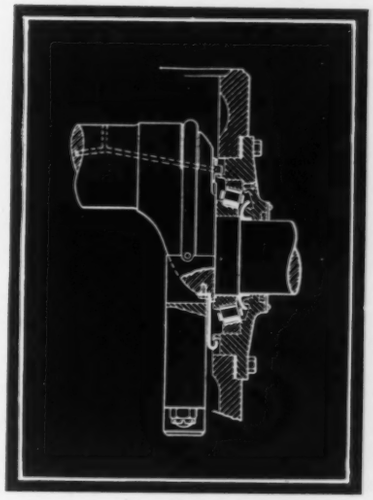
Fig. 6 — Crushed fruits and other liquids are frozen instantly in this machine which embodies mechanism for spraying the liquids on the surface of a cylinder

anism it was imperative to furnish means for instant freezing of crushed fruits and other liquids to prevent the formation of perceptible ice crystals in the confections and desserts produced by the machine.

Liquid to be frozen is poured into the funnel, *Fig.* 6, from which it flows into the hollow spindle, that attains a speed of 3000 revolutions per minute. As the liquid leaves the spindle in a fine mist it is sprayed on the surface of the cylinder. To obtain a uniform distribution of the sprayed liquid the hollow spindle travels up and down the full length of the cylinder. This vertical reciprocating movement of the spindle is controlled by a worm similar to that employed in a "Yankee" screw driver.

Operation of both the elevator and spinner motors is handled by an electric selector switch numbered from one to ten. Each numeral designates the number of up and down strokes that the spindle will make. In other words for four ounces of a material of a viscosity requiring a No. 5 inlet, five reciprocating movements are required before this quantity is painted on the wall of the freezing cylinder. As soon as the proper number of strokes is completed the selective switch engages a dog that causes a cutter head to attach itself automatically to the outer stationary tube that surrounds the revolving spindle. Subsequently, on the last or cutoff stroke this cutter head shears the frozen material from the cylinder wall, forms it in a suitable mold and delivers it into a dish. The machine is manufactured by Commercial Refrigerator Mfg. Co. Ltd., Los Angeles.

Design of Diesel Engines



This drawing, showing a single-throw crankshaft supported on single bearings, is typical of the illustrations used throughout the book

TIMELY indeed is the appearance of a new volume on diesels, which are setting a record in the motive power field. Equally noteworthy to readers of MACHINE DESIGN is the fact that Harold F. Shepherd is the author. His contributions in past issues of this magazine bear witness of his versatility and ability to give a comprehensive and understanding expose of the problems involved in the design of diesel engines, as well as in numerous other avenues of technical endeavor.

Mr. Shepherd is extremely practical, a factor that goes far in extending the value of this book. He states in his preface that the methods of calculation adopted for the various chapters are those which he has found to be understood and retained most readily by men working with him, and remembered most easily for extemporaneous work when no library is available. No derivations for formulas in ordinary use are given except in cases where it is known that existing texts containing these formulas are written more for mathematicians than for men whose natural bent is mechanical rather than scientific.

Diesel History Reviewed

Introducing his discussion with a concise historical record, he points to the work of men like Rudolf Diesel, H. A. Stuart, James McKechnie and Knut J. E. Hesselman whose early efforts constituted the foundation upon which much of our present diesel progress has been built. One is particularly impressed by the manner in which Mr. Shepherd has conserved his readers' time at this point, and throughout the book.

His discussion of design problems follows in natural sequence, with the topic of combustion as the second chapter. Other aspects of the subject are treated in the order named: Influence of the combustion chamber walls; the fuel nozzle; the fuel pump; governing; cylinder head, valves and valve gear, starting; two-cycle engine; injection of gaseous fuel; bearings and lubrication—pistons and piston rings; the indicator diagram; inertia of reciprocating parts and balancing; the flywheel; the crankshaft; reducing calculations in designing crankshaft members.

From the foregoing it will be seen that Mr. Shepherd has not slighted any of the important phases of diesel design. Facts of interest to the busy executive engineer are developed throughout the book. It is demonstrated that the laborious calculation for pole displacement of diesel-driven alternators is not necessary in the case of high-speed multicylinder diesels. It is shown by a simple algebraic method that the critical speeds of any given order are, in similar engines, a straight line function of the cylinder bore or stroke. Accelerations and velocities of cam-driven mechanisms are calculated by a simple tabular method which lacks nothing in accuracy for design purposes.

Typical of statements that are significant is this: A narrowly defined diesel fuel specification can result only in higher prices for fuel. It should be remembered that engines as well as fuel are being graded when tests are undertaken.

While the book is directed specifically to the engineer who is concerned in one way or another with diesel engines, there are many discussions of problems common to other fields. In this respect the treatise deserves a place in the library of every engineer who desires an all-around training in the mechanical arts. MACHINE DESIGN congratulates Mr. Shepherd on this excellent contribution to engineering literature. His picture and biographical sketch appear on page 45.

The book, *Diesel Engine Design,* is published by John Wiley & Sons Inc., New York, and is available through MACHINE DESIGN for $3.50 plus 15 cents postage.

How Vibration Was Obviated in Boring

By L. E. Jermy

"FLOATING power" no longer is confined to the automotive field. Nor is it employed only in isolated cases in the industrial world or in domestic machinery. The growth of this type of power mounting and transmission in machinery of many kinds is accelerating at a pace that warrants the serious consideration of designers.

An excellent example of the adoption of "floating power" in a production machine is contained in the design of the Heald Bore-Matic, *Fig.* 3, discussed in the following. In a precision boring machine of this type the necessity for elimination of vibration is obvious; particularly so when it is considered that diamonds or tools of the carbide group are employed for boring, and that finish and tool life are prerequisites to be taken care of in development of the unit.

In conjunction with the method of power transmission, Heald engineers have incorporated many other noteworthy features in the design. From the built-in motors and controls to the final appearance of the machine, nothing has been spared to turn out a unit in which refinement in design is paramount.

As will be noted from *Fig.* 1, the whole driving and pump unit is mounted on a plate to which are fastened the six vibration dampeners used to isolate from the machine proper any possible vibration arising from the power source. On former models, even with perfectly balanced motors and specially built pumps, a certain amount of vibration was set up. The dampeners,

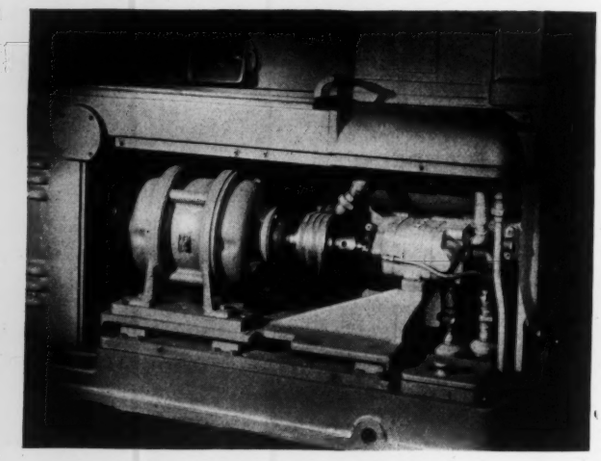
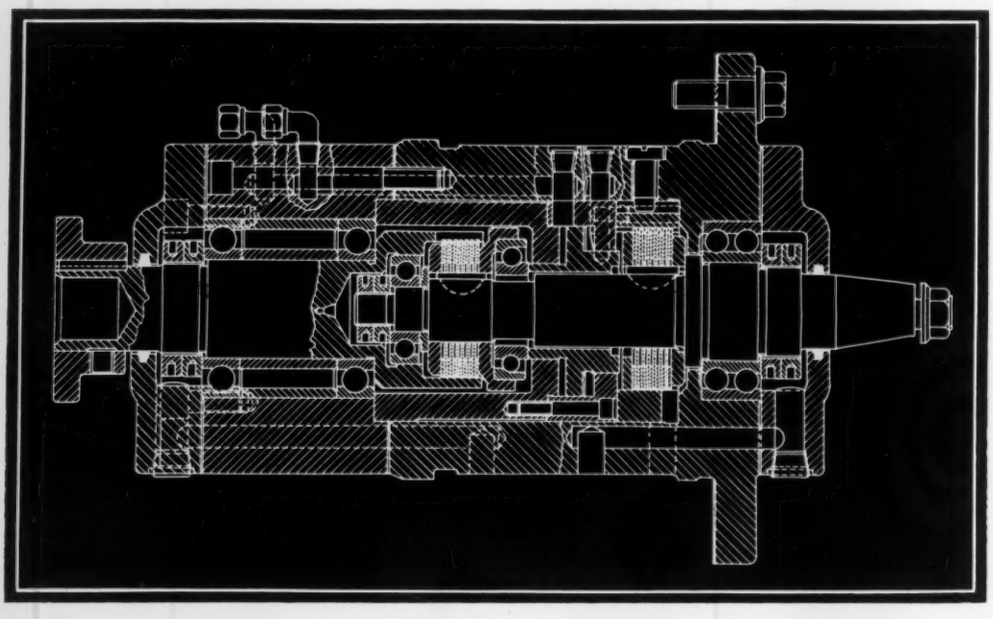


Fig. 1—*Built-in power unit is isolated on rubber dampeners*

Fig. 2—(*Below*)—*Hydraulic clutch and brake are mounted on same shaft, driven through chain coupling*



g Machine

Fig. 3—All controls are located close together at operator's station. Motor push buttons are in panel at left

in which rubber is used as the absorbing element, have eliminated this difficulty entirely.

Further means of isolation are of course used to prevent any vibration being transmitted through the hydraulic piping that runs to and from the entrance and discharge ports of the pump. On the piping from pump to oil reservoir a special gland—seen at the right of *Fig.* 1—is employed. The pipe has a flanged cap which fits over an annular cork seal pressed over a tube extending upward from the surface of the cover plate.

On the piping from the pump to the oil passages of the machine, short lengths of protected hose are inserted. The only other connection between driving unit and machine is through the main drive, and for this V-belt is used.

Fig. 4—Mainshaft is connected to tool spindles through V-belt drive, with adjustable take-up idlers

Clutch and Brake Units Combined

The V-belt drive is taken by a pulley mounted on a shaft in line with the clutch and brake unit shown in *Fig.* 2. Two of these units are used, one for right-hand and the other the left-hand end of the machine. Connection between the driven shaft and clutch and brake unit shafts is through the new form of chain coupling.

Experience with earlier models of this type of machine had proved that it was practically impossible to obtain a sufficiently smooth running drive with a mechanically-operated clutch and brake unit. Therefore hydraulics has been adopted for controlling this mechanism, as well as all other reciprocating movements in the machine.

At the tapered end of each of the clutch shafts is mounted the V-belt pulley for driving the tool spindles. This pulley, and the drive for one end of the machine, is shown in *Fig.* 4, the drive at the reverse end of the machine being arranged in a similar way. This means that the spindles revolve in opposite directions if viewed from the

pulley ends but that they rotate in the same way insofar as the operator is concerned, namely, with the top coming toward the front of the machine in each case. The driving arrangement thus is simplified.

Spindle Bearings Are Preloaded

Another change from previous models of the machine has been incorporated in the design of the tool spindles, shown in *Fig.* 7. Two single ball bearings formerly were used, placed close together at each end of the spindle. While these were effective in regard to preloading, it has been found advantageous to space each pair of bearings apart as shown. This procedure has reduced the length of unsupported shaft at the center and has been the means of eliminating any possibility of shaft whip or vibration.

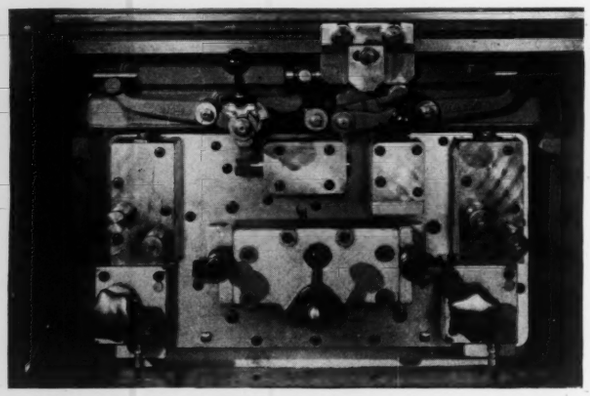
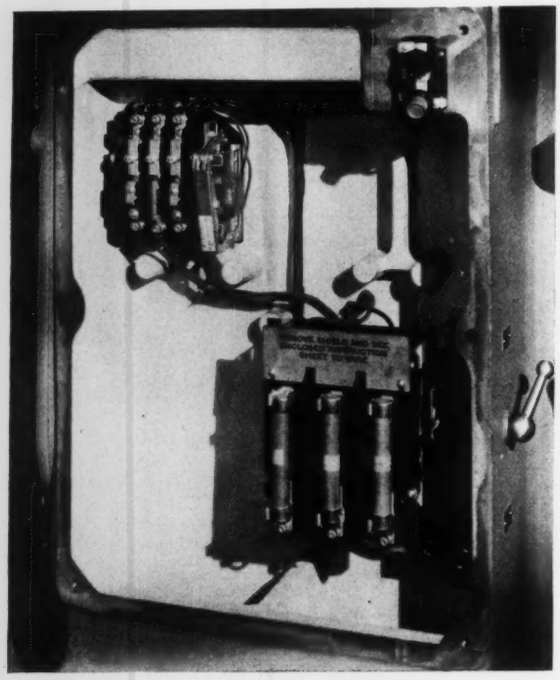


Fig. 5—*Control panel, eliminating piping to valves, is built up of matched plates with cored oil passages*

Fig. 6—*Motor control with cover removed to show built-in construction*



Conventional methods are employed in the preloading, the inner races of the bearings being locked on the shaft and the outer races kept under preload by spring tension. As will be seen from the drawing, three of the four outer races have clearance at the side, thus providing for float in the mountings as automatic spring adjustment takes place.

In order to provide a simple method of final adjustment of the tool, the quill that carries the cutter bar has an eccentric plug that may be rotated in the bushing at the end of the spindle. Graduations are marked on the periphery of the spindle flange, and a zero mark is carried on the quill. By turning the quill either way from the zero mark it is possible to adjust the tool two-tenths on the diameter for each graduation. It has been found that balance of the spindle is not affected by the small amount of eccentricity under maximum adjustment.

Lubrication, in the case of these spindles, is by wick feed. Other points in the machine, however, are lubricated from the hydraulic system. Lubricating oil returns to the reservoir at the rear of the machine, this being possible because all mechanisms are fully protected against the entrance of foreign matter. A separate unit, consisting of an individual motor and coolant pump, is employed for the cutting lubricant used for certain metals.

Hydraulic Piping Is Eliminated

Simplification of the hydraulic system is effected by a reduction in the amount of piping employed, and the use instead of cored passages in matched plates fitted at the valve and control section of the machine. This is illustrated in *Fig.* 5. The plates are surface ground to obviate the use of gaskets, and to allow ready removal of the plates in case the operating cycle needs to be changed for different classes of work, etc.

This arrangement of matched plates not only is advantageous from the standpoint of changing the hydraulic cycle but it results in the entire elimination of excessive piping with sharp bends. Furthermore the plate construction permits a practically solid supporting wall for the front V-way of the table.

Electric Controls Are Built In

Advantages of built-in electric control, as adopted by many of the leading machinery builders of today, is capably recognized in the design of this borer. *Fig.* 6 shows the method of mounting the controls and push buttons, the panel or cover of the switch enclosure being removed to show the interior. This panel, with the push buttons protruding, can be seen at the left of *Fig.* 3.

The primary aim of the designers of this ma-

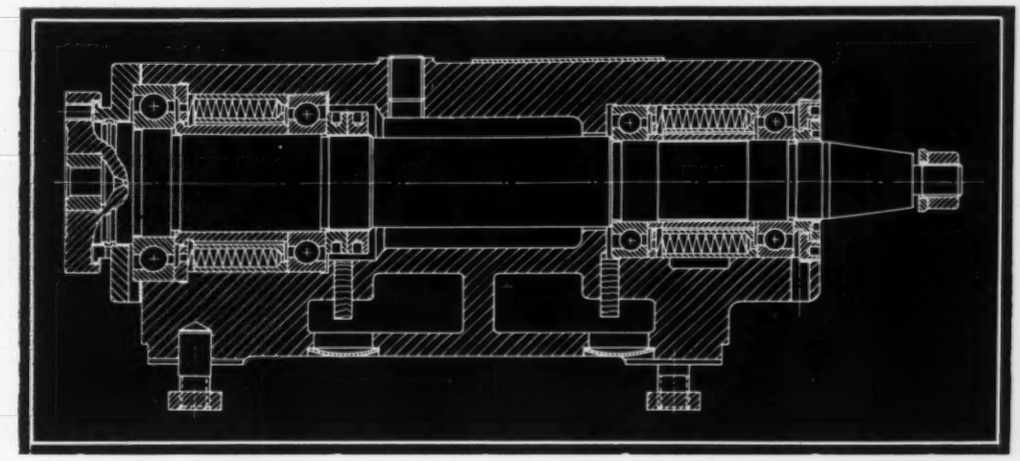
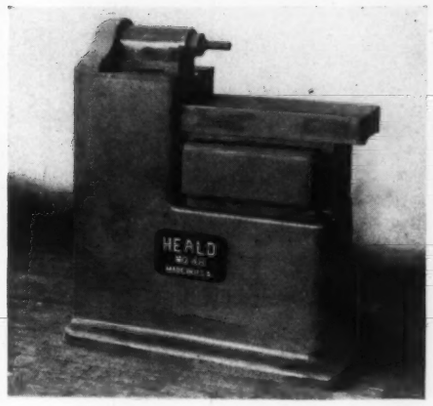


Fig. 7 — Preloaded antifriction bearings prevent vibration of spindle at all speeds. Fig. 8 — (Below) — Wooden model of earlier machine used for appearance investigation



chine was not only to develop a unit that would turn out precision work, but one that would *look* capable of doing its job effectively. A glance at the complete machine illustration on page 25 will show how well this aim has been achieved. With both the power unit and its controls mounted within the frame there is not a single square corner or projection that might mar the effect of smoothness and stability—an aim so keenly sought in these days by designers of automobiles and certain other types of machinery, but rarely accomplished in machine tools up to the present. The only part in the boring machine that is detached from the machine proper is the reservoir, motor and pump for the cutting lubricant, these being placed as a unit at the rear of the machine.

Hollow Head Screws Are Employed

To preserve smoothness of surface, hexagon head cap screws have been discarded in favor of hollow head "safety" cap screws throughout the machine. The whole structure is cast iron, the larger exterior surfaces being broken up by louvers and hand holes that serve the purpose of ventilation and handling as well as furnishing a pleasing effect. Instruction plates and insignia also are used to advantage in breaking up surfaces that otherwise might appear too "flat."

All of these accomplishments in obtaining pleasing and, at the same time, massive appearance have occurred over a period covering the development of this and earlier machines during several years. One of the earlier machines, a single-head unit, is shown in the form of a full size wooden model in *Fig.* 8. Models of this type were made up for the design staff and subjected to the critical eyes of management, sales and advertising departments before final decision. It is by such methods rather than by leaving things to chance and "second thought" that our best and most salable machinery is being produced.

They Say—

"Too many manufacturers misunderstand the true function of improved equipment. It is not necessarily to increase production. It *is* to reduce costs and aid you to get a larger profit from the same or smaller volume of profit."—from *The Hunter Counselor.*

□ □ □

"Labor cannot be paid high wages for short hours, except as engineers and machinery and planning make work able to earn high wages with short hours. Without machinery and organization and quantity production no man can earn high wages with his hands alone. The intelligence of management and designers must supplement the mind and brawn of the man with the unerring accuracy of the machine."—William B. Stout.

□ □ □

"It takes more men to make a machine of 15,000 pieces, like today's models, than to make one of 3000 pieces like the early cars."—Henry Ford.

By Harold B. Veith

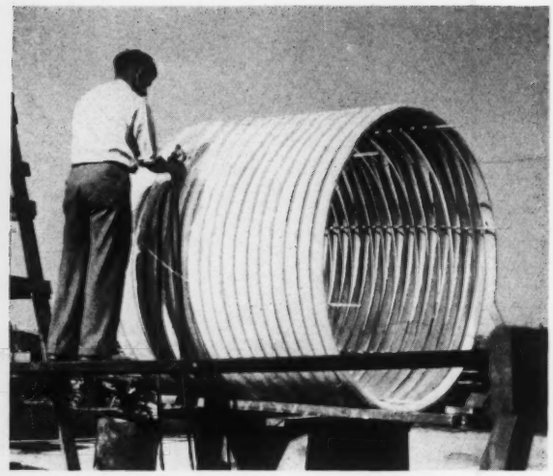


Fig. 1—Application of aluminum to this pipe coil exemplifies the portability of the metal spray gun

Protecting Machine Parts by Metal Spraying

METAL spraying, a process that is being widely discussed and gaining in use rapidly, supplements the various available methods of coating machine parts to prevent corrosion. Decorative finishes and a means of building up worn surfaces also are provided by this method. Consisting essentially of applying various metals in molten state with a specially constructed spray gun, the process has many advantages.

Metals such as aluminum, stainless steel, monel, bronze, brass, zinc, lead and tin, are fed into the gun mechanically in the form of wire. The wire subsequently passes into an oxacetylene flame, is melted and by an air blast is atomized into fine particles which are sprayed on the surface of the part to be coated.

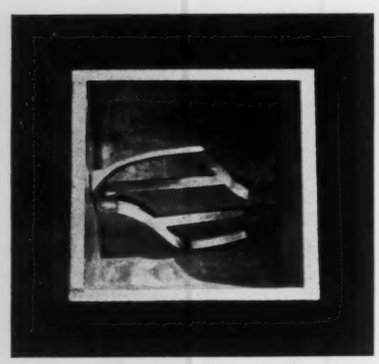


Fig. 2—Sprayed with tin and polished, this cheese mixing tank thus was coated to prevent contamination of the product

Data Covers Sprayed Aluminum

Portability of the self-contained gun by which the process is carried out is illustrated in *Fig.* 1. The unit being sprayed is a large pipe coil to which is being applied a 0.010-inch coating of aluminum to prevent it from contaminating a vegetable oil product. The inside of the tank also was sprayed, using ninety-five pounds of 12-gage aluminum wire. Time and material spraying cost amounted to eighteen cents per square foot. One-sixth pound of aluminum was applied per square foot. It is interesting to note that the rate of application varied from four to seven pounds per hour, depending on the size of wire employed.

Where necessary it is possible to coat a portion of a surface with one type of metal and the remainder with another. Layers of the metals also may be alternated, one upon another. Ferrous metals may be applied to nonferrous

metals and vice versa. The sprayed finish cools instantly, is hard and dry, thus obviating any loss of time between application and use.

In respect to the type of finish obtained by this process, examination of photomicrographs discloses that the molten metal coatings are made up of a multiplicity of plastic particles. The high velocity impact on the surface to which they are forcibly applied by the gun leaves them flattened out and interlocked, first with the microscopic grain of the surface on which they are deposited and subsequently with each other. No claim is made that sprayed molten coatings are either welded or brazed to the base metal. The firm adhesion obtained is due solely to the mechanical bond.

Sprayed molten metal deposits will not peel or spall, may be machined, filled, ground or worked in the same way as original metals. The bond compares favorably with the best types of brazing, hot dipping or electroplating. Machine parts usually are tool roughened and then sand blasted with a special sand or steel grit, immediately prior to spraying. For maximum adhesion a properly roughened surface is essential.

Provide Protection Against Corrosion

To protect iron and steel from atmospheric corrosion zinc is the most practical anodic metal that can be used for sprayed molten coatings. Aluminum also provides a coating that gives efficient protection against corrosion, particularly where acid conditions or high temperatures prevail. While tin, copper, lead, brass and bronze are cathodic to iron and steel, they are used to provide resistance to acids, etc. If a hard surface is necessary high carbon steel is applied, but it must be ground to finish inasmuch as the brinell reaches approximately 375 after spraying.

Fig. 3—Corrosion of these parts was combatted by sprayed coating of monel and antimony lead

Fig. 4—Conveyor press for fruit industry sprayed with stainless steel 0.040-inch thick to resist corrosion

Metal spraying is gaining extensive use as a decorative medium because of the possibilities it possesses in this type of work. Besides metal trimmings and decorative coatings, attractive patterns may be produced by means of stencils.

Evidence of the advantages offered by the process is best illustrated by the following case studies. Tin is used in instances such as the cheese mixing tank, *Fig.* 2, which is sprayed with this material and polished to eliminate contamination of the food product. The coating of 0.003-inch zinc and 0.015-inch tin amounted to six pounds of zinc and thirty-four pounds of tin. Zinc always is used under tin for better bond and to prevent difficulties arising from possible pin holes in the sprayed tin.

Metal Spraying Benefits Pump

Advantages of a combination of monel and antimony lead are brought out in the spraying of cast iron impellers and pump cases, *Fig.* 3, used in iodine manufacture. This small pump lasts only about six weeks and costs forty-two dollars. To combat the corrosive effect of the chemical handled, the pump was sprayed with 0.010-inch coating of monel and 0.010-inch of six per cent antimony lead. Now the unit remains in service about eight months before it is necessary to respray.

On a bronze lemon press housing and screw, *Fig.* 4, fourteen pounds of stainless steel averaging 0.040-inch thick is sprayed. In another instance where this type of material is used, it protects heavy cast steel valve bodies used in controling hot oil at 900 degrees Fahr. and pressures of 1000 pounds. Corrosion under these conditions was rapid. One large refinery covers such parts with sprayed stainless steel 1/16-inch thick as standard practice.

MACHINE DESIGN wishes to thank E. V. David, applied engineering department, Air Reduction Sales Co., and H. B. Rice, Metal Spray Co., for their assistance in the preparation of this article.

Predesign Survey Indicates Mixer Essentials

By Allen F. Clark

Fig. 2—Mixer design incorporates safety provisions for both machine and operator

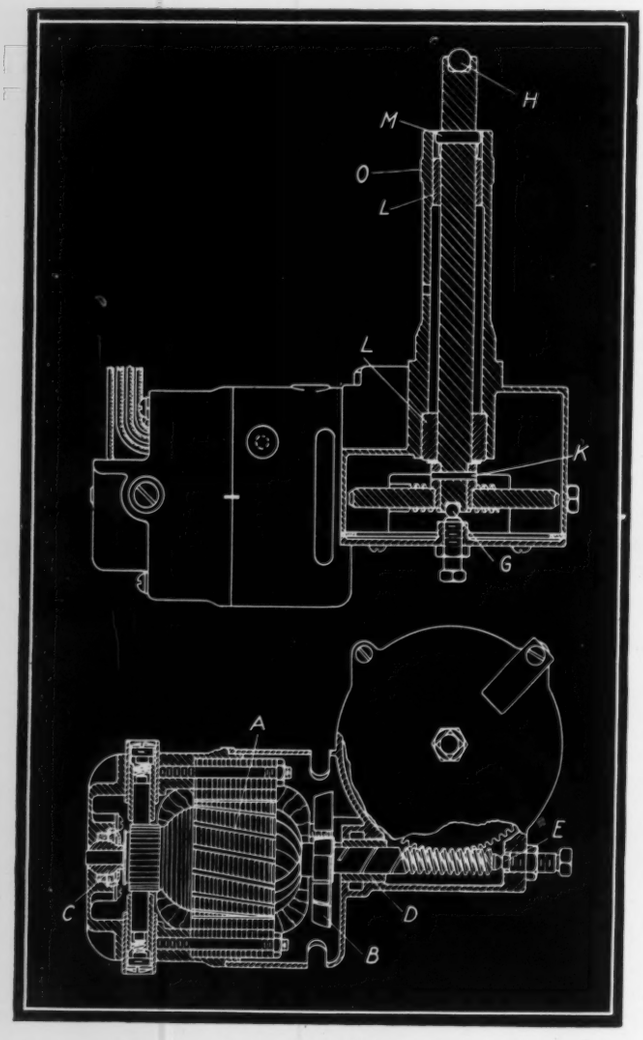


Fig. 1—Bearings which support the armature shaft as well as all other bearings are of composition material

EVERY machine has, as the major motif in its design, the performance of a certain task or series of tasks in the easiest, quickest, most efficient way. This fact is the logical reason for making new designs, yet it frequently happens that new machines are developed without sufficient data on: Conditions of use; general knowledge and capabilities of the operators available; and basic characteristics desired by the user. A careful study of conditions, actual operation of sample machines on typical jobs, and interviews with prospective or present users will usually result in the development of specifications for a new design that will permit the construction of a unit satisfying all requirements.

A predesign investigation following these general lines enabled the P. A. Geier Co. to set up a number of specifications that functioned as a series of problems to be solved in the design of the Culinaire, *Fig.* 2. This machine mixes and beats foods, extracts fruit juices, slices vegetables, grinds and chops meats, etc. Major requirements set up by the research were: The motor must be located at some point where it would not be possible for grease or oil used in lubrication to drop into the food; there must be sufficient power for speed in performing the tasks required of the unit; there must not be any "dead spot" in the bowl that might increase mixing time; and changes and adjustments for adapting the machine to different tasks must be as simple as possible so that the housewife will have no difficulty with them.

A number of other problems were, of course, involved. An especially interesting one to the

engineer is the choice and design of bearings, another covers safety provisions for both the machine and the operator, while a third is the design of the mixing bowl and the selection of a material for this bowl.

As the location of the motor vitally affects practically every other detail in the machine, this was the first problem to be solved. In order that grease and oil would not contaminate the food, the three-speed motor was located in the base of the machine, lower than the food bowl, and power for the mixers and other units is taken off the power shaft rising in the center of the bowl. The base is a stamping. Placing the motor in the base also lowers the center of gravity of the machine, thus eliminating the danger of tipping.

Acceleration Is Smooth

All electrical portions of the motor, which develops about one-quarter horsepower, are included in a single unit which can be taken out easily and replaced without the necessity of more or less complicated repairs in the home. Slots in the rotor of this motor are cut diagonally as at *A, Fig.* 1, thus enabling perfectly smooth acceleration without pulsations and with

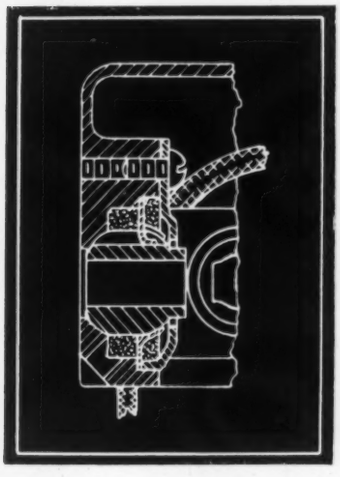


Fig. 3—Bearing is self-aligning to insure correct alignment of the armature shaft under unusual conditions

reduction of noise, a necessary requirement in domestic machinery. A stamped steel fan, *B* in *Fig.* 1, keeps the temperature of the motor within allowable limits regardless of the duration of run or the load.

Bearings which support the armature shaft, *C* and *D Fig.* 1, as well as all other bearings in the machine, are of a composition material. This material is copper powder, tin and graphite molded under pressure. After molding, the bearing is heat treated to remove the graphite. This treatment gives a porosity to the bearing which enables it to hold the lubricant.

It was found by the designers of the mixer that bearings of this type must be specially designed for the particular application. They must be in absolute alignment and no binding is permissible. Such bearings are not oilless even though they do not require the lubrication attention usually associated with bearings. The composition type holds lubricant in its pores, the heat action of the shaft drawing it out in minute quantities to provide the necessary lubrication. In the mixer being discussed, light grease is placed in grooves behind the bearings. As the bearing heats up, this grease is liquified and filters through the pores to the shaft.

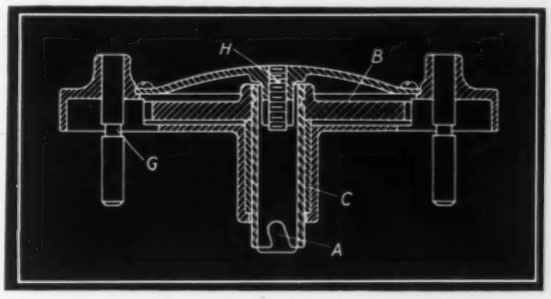


Fig. 4—Zinc die castings are employed for gearing which drives beaters

Lubrication attention required while the machine is in use is only the addition of two or three drops of oil a year to the grooves. Oil is specified for this renewal rather than grease as the light grease originally placed in the grooves might solidify slightly and the oil will tend to maintain the orignal viscosity.

Steel Fingers Hold Bearing

The bearing *C, Fig.* 1, shown in greater detail in *Fig.* 3, is self-aligning to insure correct alignment of the armature shaft. The exterior of the bearing is arcuate in shape, and the housing is of similar shape. Steel spring "fingers" hold this bearing in whatever position a possible misalignment of the shaft may carry it, yet allow it to shift further with respect to the axis of the shaft should this be necessary. Felt seals prevent lubricant which might be drawn from the bearing from entering the motor.

In addition to the self-aligning feature, thrust of the nickel alloy armature shaft is taken by a steel ball, seated on the end of the shaft, which abuts on an adjustable plate, *E, Fig.* 1, of the composition bearing material noted in the foregoing. A groove is cut on the armature shaft to prevent lubricant from being carried from the worm gear into the motor. The entire armature assembly is dynamically balanced for quietness.

The worm wheel that is pressed on the drive shaft of the machine is made from a phenolic resinoid material. It was found advisable by testing to cut the teeth on this worm wheel

after it was pressed on the shaft rather than to cut these teeth first and then press the wheel on. This method of manufacture insures a wheel exactly centered in all elements around the shaft.

In the preliminary study of the requirements for the machine it was determined to use a single drive shaft rather than two or more so that there would be no confusion in attaching the various accessories used with machines of this type. It was further decided that the speed of this shaft should be the minimum with the highest torque needed in any of the operations. One method of designing mixers is to have the drive shaft deliver the high speed necessary for the beaters, then gear this speed down for the accessories. However, as this method does not give the torque desired by the designers of the machine being discussed, the reverse method of having the shaft deliver the low speed at all times, then gearing it up for the beaters was adopted.

Steel Ball Takes Thrust

Thrust of the drive shaft is taken by a steel ball at *G*, *Fig.* 1, which in this case, abuts against a steel surface. A special bearing surface was found unnecessary at this point. Another steel ball at *H* carries the weight of the beaters or the accessories. A shear pin at *K* protects the machine against damage, while it is so located that it is easily renewable. The shaft

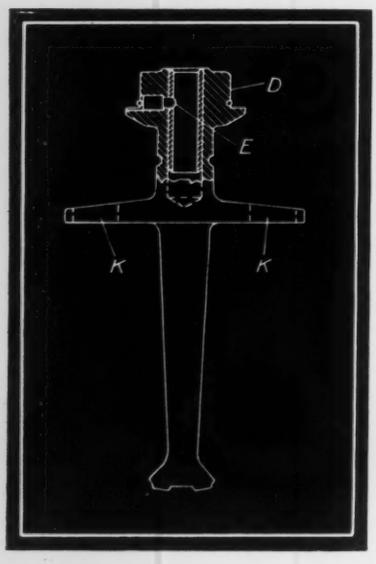


Fig. 5—Beater posts are held firmly in place yet are easily removed for cleaning purposes

itself runs in composition bearings at *L* while the beaters and accessories are driven through the drive pin *M*.

Gearing for increasing the speed of the drive shaft to that required for beating and mixing is provided by a large gear in the beater holder assembly, *Fig.* 4, and a gear on the top of the beater posts themselves, *Fig* 5. The beater holder assembly which rotates through the action of the drive shaft fits down over the top of the drive shaft with the slot at *A*, *Fig.* 4, meshing with the drive pin. This slot is cut at an angle so that the driving action will tend to hold down the assembly rather than to throw it upwardly and off.

The large gear *B* in *Fig.* 4 is a zinc die cast-

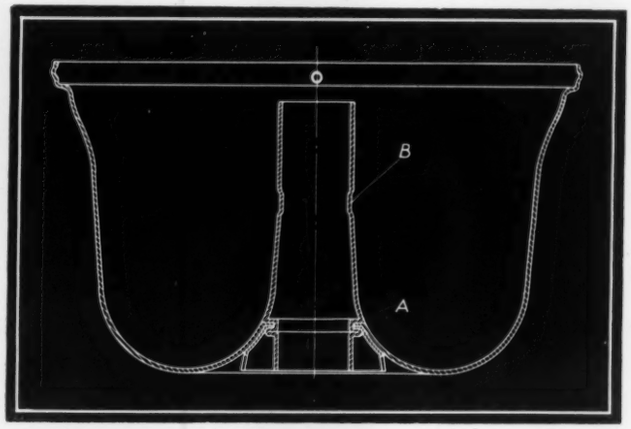


Fig. 6—An assembly of an aluminum stamping and an aluminum tube is used to construct the bowl

ing, the shaft of which turns in another composition bearing *C*. This gear meshes with the gear *D* in *Fig.* 5. The spring-held point *E* on the beater posts of *Fig.* 5, fits into the grooves *G* on the shafts of the beater holder assembly in *Fig.* 4. This assembly holds the beater posts firmly in place, yet permits their easy removal for cleaning. Composition material is again used for the bearing surface between the beater posts and their shafts. Some adjustment in the clearance of the beater holder assembly and the beaters from the bottom of the mixing bowl is provided by the setscrew *H*, *Fig.* 4, which bears on the steel ball on top of the drive shaft that was mentioned earlier.

Beater Units Are Aluminum

Aluminum, fabricated by die casting, was selected for the beater units, the method of fabrication chosen because of the simplicity of producing more or less intricate shapes, and the material selected because it can be used in contact with food products without danger. In the first designs both the beater post, *Fig.* 5, and the blades were included in a single die casting. While this design was perfectly practical from a production standpoint, it was found that in the event that the operator of the machine dropped a spoon or some similar solid into the machine, there would have to be some degree of spring in order to keep the machine from jamming

(*Continued on Page* 66)

Plastics—New Materials of Engineering

AFTER the market for a machine has been assured and design problems involving mechanical movements considered, the question of materials confronts the engineer. In previous models he may have used metals entirely but, particularly for the lighter types of machinery, there is now a new classification to consider—plastics. The designer finds an imposing array of molding materials from which to choose, as disclosed by the directory on pages 34, 35 and 36. A perusal of their properties and applications will reveal a wide range of adaptability.

Although each case needs careful consideration the designer has certain precedents to guide him. Millions of machine parts successfully produced from plastics now are in use. Such factors as appearance, production economy which includes the important items of surface finish, have played a large part in the adoption of this type of material. Because of the range of colors available the matter of decorative coating costs may be dismissed immediately. This feature is an inherent characteristic of most plastics.

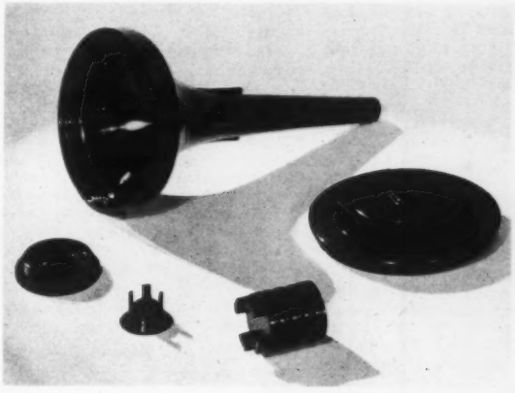


Fig. 1—Attractive, these parts molded from a urea-formaldehyde plastic

Fig. 2 (Left)—Phenolic resinoid parts are water-resistant to withstand submersion in the bottom of a tank

Some of the more recent applications of plastic materials include a new scalp massaging device, *Fig.* 3, for which a phenolic resinoid material is used. This unit proves that size is not a limiting factor. The necessary strength is available also.

Another significant use of the phenolic resinoid type of plastic is found in the Mitchell ignition switch. This switch is molded, and a piece of hard laminated phenolic resinoid is attached to the top surface, resting on the shoulders formed on the copper alloy contacts that previously have been pressed into the switch body. A smooth glossy surface is obtained which does not wear under action of the switch rotor but is burnished by it.

A glance at *Fig.* 1 reveals the attractiveness of parts molded from a different type of plastic—urea-formaldehyde. Cellulose acetate is still another type filling many requirements.

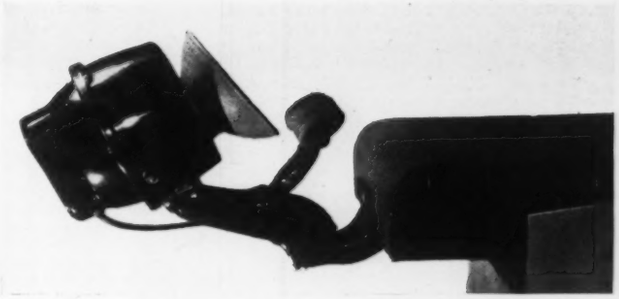


Fig. 3—This massaging device of a phenolic resinoid plastic illustrates a unique mechanical application

Photos courtesy Toledo Synthetic Products Inc., General Plastics Inc., Bakelite Corp.

Directory of Plastics

Compiled for the assistance of engineers engaged in design of machinery

ACE—Hard rubber, resistant to most acid and alkali solutions and fumes. Tensile strength 6500 to 9000 pounds per square inch; compressive 11,000 to 12,000. High electrical insulating values at low and high voltages and frequencies. Excellent thermal insulating qualities. Nonflammable; readily molded or machined to desired shapes. Physical and mechanical properties may be varied. Applications include parts in automotive and X-ray equipment, refrigerators, textile, chemical, electrical, printing and mining machiney, etc. American Hard Rubber Co., 11 Mercer street, New York.

AETNA—Hard rubber high in tensile strength and elongation. Unusually low in specific gravity. Used for storage battery containers, vent caps, gaskets, racks, nuts. Rods and sheets available. Aetna Rubber Co., Ashtabula, O.

AJAX—A hard rubber that resists the corrosive action of chemicals such as acids and alkali solutions, and withstands moisture. Electrical properties include high insulating values exceptional at both low and high voltages and frequencies. Readily molded and machines easily to desired shapes and designs. Characteristics render the material suitable for handles, bushings and other machine parts to specification. Vulcanized Rubber Co., 261 Fifth avenue, New York.

ARCOLITE—Phenol-formaldehyde molding material. High dielectric and a tensile strength of 6500 pounds per square inch. Parts come from the mold hard, with clear polished finish. May be molded around or over metal or wood cores in parts requiring greater strength and rigidity. Can be drilled, tapped or machined, or threads may be molded-in accurately. Resistant to water and other solvents. Molded in any color, plain or mottled. Applications include machine frames and other components, electrical parts, etc. American Record Corp., Scranton, Pa.

BAKELITE—Phenol resinoid having high dielectric and mechanical strength, resistance to heat, moisture, alkalies and most acids. In laminated form for bearings, gears, pump valves, rollers and washers, vibration-absorbing machine mountings, etc. The molded form is adaptable to such applications as magneto cases, pulley wheels, lathe handwheels, control buttons, spinning buckets, insulation parts, etc. Transparent cast resinoids fulfill mechanical requirements as gear handles, levers and knobs, gages and dials. Bakelite Corp., 247 Park avenue, New York.

BANNER—A black hard rubber of fair lustre, with a tensile strength of 4000 to 7000 pounds per square inch; compressive strength 10,000 to 11,000. Can be furnished in rods and tubes, as well as in sheet form. Recommended where finish or delicate machining operations are not of utmost importance. Natural color of hard rubber is black, but can be supplied in various colors, green, blue, red, violet, brown and gray, and mottled colors of various combinations. Molded applications cover wide range of machine parts. American Hard Rubber Co., 11 Mercer street, New York.

BEETLE — Urea-formaldehyde molding powder. Natural color is a translucent ivory, permitting easy pigmentation to attain any desired shade. Available in whites and pastel tints as well as in a complete range of all solid colors. After fusing to the desired shape it cannot be softened subsequently by heat and pressure to be reshaped, but remains rigid and durable. Tensile strength 5000 to 7000 pounds; compressive strength 24,000 to 26,000 pounds per square inch. Electric clock cases, auto knobs and handles, electric vibrator handles, fruit juice reamers and extractor bowls, etc., are some of its uses. Synthetic Plastics Co. Inc., Unit of American Cyanamid Co., 535 Fifth avenue, New York.

CATALIN—A cast phenolic resin, available in rods, sheets, tubes or special castings. Nonflammable, absorbs almost no moisture, resists alcohol, oils and most common acids. Has high dielectric, tensile and compressive strength; holds its shape and color and works freely, similarly to brass or hard wood. Furnished in a variety of basic colors, opaque, translucent and transparent, in either plain colors or with mottled or grained effects. Applications include clock and instrument cases, auto fittings, knobs for electrical appliances and other machine parts. American Catalin Corp., One Park avenue, New York.

CELLANITE — Laminated non-phenolic synthetic resinous insulating material. Odor repellant, has high electrical and thermal insulating properties combined with structural strength. Adaptable to all machining operations. Widely used for frost breaker strips on refrigerator cabinets. Continental-Diamond Fibre Co., Newark, Del.

CELORON—Manufactured by impregnating sheets of woven fabric such as cotton duck or linen with synthetic resin, superimposing one sheet upon another until the required thickness is attained. The entire mass then is subjected to pressure and heat in a press. Impervious to temperature changes, oil and water, and is not affected by oxidation. Grade C (canvas base) for heavy duty spur, helical, bevel or worm gears. Has high impact strength and shock obsorbing properties. Type L (linen base) for small gears of fine pitch and narrow face. Continental-Diamond Fibre Co., Newark, Del.

CETEC—Cold molded plastic molded to shape at room temperature and then heat treated to impart strength and toughness. Two general types: Nonrefractory, containing organic ingredients such as asphalt as a binder, with asbestos as filler; and refractory containing inorganic ingredients such as cement and drying oils as a binder, with an asbestos filler. Properties include mechanical strength, rigidity, resistance to high temperatures. Adaptable to moderately complicated shapes. Not recommended for parts requiring high dielectric strength or thin sections. General Electric Co., Schenectady, N. Y.

CODITE—Distinguished from vulcanized fiber by its greater flexibility, plasticity, higher electrical insulating properties and greater mechanical strength. Hard, tough, somewhat translucent and thermoplastic. Machines easily and takes high polish. Tubes may be expanded in diameter or spun or pressed in a heated die. Extruded washers have been fabricated with a shank measuring 0.070-inch and a flange of only 0.023-inch. Continental Diamond Fibre Co., Newark, Del.

DIAMOND — Vulcanized fiber. Hard, dense, bone-like material that is tough, pliable and strong. Its great physical strength and high dielectric strength and adaptability to all machining operations make it a universal raw material. Available in various forms such as insulation made in sheets and continuous rolls; flexible fiber for washers and gaskets; sheets, rods and tubes. Insulating members, gears, bobbin heads, etc., are fabricated. It may be turned, sawed, sheared, punched, etc. Continental-Diamond Fibre Co., Newark, Del.

DILECTO—Laminated synthetic resinous material, waterproof and possesses great mechanical strength and adaptability to machining operations. Light in weight (about one-half the weight of aluminum), and is supplied with either mirror-like surface or dull satin finish, in two standard colors, a lustrous black and natural which varies from a golden to a deep brown. Also furnished in pastel shades, natural wood grains and in modernistic designs. Made in three primal forms, sheets, rods and tubes. Uses include silent gears, for which graphite Dilecto is used where lubrication is difficult or likely to be overlooked. It also is used for thrust washers, bearings and bushings. Continental-Diamond Fibre Co., Newark, Del.

DUPRENE—Synthetic rubber, resistant to oil, heat and oxidation. E. I. Du Pont De Nemours & Co. Inc., Wilmington, Del.

DUREZ—Phenolic resinoid molding compound with high dielectric strength. Possesses permanent wearproof finish which withstands scuffing, etc. Adaptable to the use of metal inserts to insure complete rigidity. Particularly suitable for applications requiring close tolerances in molding and where moisture resistance is necessary to prevent

changes in dimensions. Furnished in wide range of colors. Machine parts for which this plastic is used include foot treadles, business machine parts, electrode panels, parts for motors, ignition devices, etc. General Plastics Inc., North Tonawanda, N. Y.

DURITE—A comprehensive line of phenol formaldehyde, phenol furfural synthetic resinous materials including pure resins in dry, liquid or varnish forms, hot press molding powders, laminating varnishes, etc. Chemical, electrical and mechanical characteristics can be varied according to the type of part for which they are specified. Suitable for molding a variety of machine parts. Durite Plastics, division of Stokes & Smith Co., 5010 Summerdale avenue, Philadelphia.

EBROK—An acid resisting bituminous plastic for specific requirements including such parts as battery containers. Richardson Co., Melrose Park, Ill.

EEL-SLIP—A compound of asbestos fiber, graphite and rubber. Has high tensile strength and is heat resistant. For bearings, suction box covers, etc. Johns-Manville, 22 East Fortieth street, New York.

FORMICA—Combines with its insulating qualities and high dielectric strength, a high degree of mechanical strength and low moisture absorption. Tensile strength is slightly lower than cast iron but much more elastic, adapting it to use for gears that are quiet and durable. Absorbs no oil and changes in dimensions only slightly as the result of moisture absorption. Used for insulating washers and bushings, punched insulating parts in switches, automotive starting systems, radio apparatus, X-ray equipment, etc. Formica Insulation Co., 4614 Spring Grove avenue, Cincinnati.

HARVITE—Available in a variety of colors and can be molded into various shapes. Good electric insulator and will withstand temperatures up to 190 degrees Fahr. This material does not have sufficient strength to make it suitable for gears, frames of light machines or similar machine parts but it is finding its market in other applications. Siemon Co., Bridgeport, Conn.

HAVEG—An asbestos base combined with phenol-formaldehyde resin. High acid-resisting properties, low heat conductivity and does not chip or fracture easily. Haveg Corp., Newark, Del.

INDUR—A group of plastic materials comprising insulating varnish, laminating varnish, molding powder and molding resins. Properties variable according to the application for which they are intended. These materials are employed in the molding of gears, instruments and other machine parts including insulating panels, knobs and handles. Reilly Tar & Chemicals Corp., Merchants Bank building, Indianapolis.

INSUROK—A laminated phenolic product in sheets, rods, tubes, gear blanks, bearings and fabricated parts in several grades for different applications. Has toughness, heat resistance, low water absorption, high dielectric strength, resilience, lightness and workability. Non-corrosive, not affected by age, resists most re-agents, acids, solvents, oils, etc. Richardson Co., Melrose Park, Ill.

KOROSEAL—Synthetic rubber-like product. Some of its characteristics render it far superior to rubber for certain specialized applications. May be varied by compounding methods for very hard to soft doughy consistency and can be molded into any shape. Resists corrosive chemicals. Odorless and produced in a variety of colors. Useful where rubber consistency combined with superior resistance to many oils and chemicals or to flexing, is required. B. F. Goodrich Co., Akron, O.

LACANITE—Molding compound with great dielectric strength, does not absorb moisture, and withstands heat up to 150 degrees. Exceptional tensile strength and takes all finishes. Made in all colors including white, and available for wide range of uses. American Record Corp., Scranton, Pa.

LAMICOID—Standard sheet stock in various grades including a high grade punching stock with paper base. Not affected by dilute acids or oils. Recommended where stiffness, good electrical properties, surface resistivity, etc., are concerned. Also flexible grade punching stock, as well as a general all-purpose paper base stock which combines electrical and mechanical properties, and low moisture absorption. The linen stock for those uses requiring fine machine work and intricate punched parts; also employed for small fine tooth gears and pinions. Supplied also in tubing and rod form as well as washers, disks, gear blanks and pump valves. Lamicoid decorative plate and bonded metal are available in a complete range of designs and in color combinations. Mica Insulator Co., 200 Varick street, New York.

LIGNOTITE—Plastic material in powder form for hot hydraulic press molding. Extremely tough with high mechanical and dielectric strength. Resistant to oil, water, heat and most chemicals. Basis is casein to which are added certain solvents, fillers and the necessary coloring matters demanded in the article to be molded. Lignotite Co., 2727 Archer avenue, Chicago.

LUMARITH — Cellulose acetate, non-flammable material. Flexible and adaptable to any contour or shape. Permanently retains color. In sheets, rods, tubes, rolls and molding powders. Celluloid Corp., 10 East Fortieth street, New York.

MAKALOT—Synthetic resins, varnishes, cements and molding powders. Various grades and types are available to fill a wide range of uses which include automotive and radio parts. Flowing and covering qualities of these resins eliminate sticking troubles. Adaptable to the production of large and complicated articles where high strength and shock resistance are considerations. Makalot Corp., 262 Washington street, Boston.

MARBLETTE—A cast phenolic resin now used commercially for parts requiring machining. These cast synthetic resins are somewhat softer than molded materials and can be easily turned, drilled, sawed, threaded, carved, and highly finished by polishing. Marblette Corp., 37-21 Thirtieth street, Long Island City, N. Y.

MICABOND—Resistant to heat, high in dielectric strength, easy to machine or form to shape. Supplied in molding plate, segment plate, heater plate, flexible sheets, tape, tubing and in punched and formed parts such as V-rings, washers, segments and other special shapes. Continental-Diamond Fibre Co., Newark, Del.

MICARTA—A laminated resinous material formed by action of heat and pressure on a number of layers of paper or fabric which has been impregnated with a synthetic resin. Properties include strength, resilience, light weight, long life, resistance to heat, corrosion, excellent electrical insulating properties, and good machining and punching characteristics. By proper choice of the laminating material and synthetic resin almost any desired combination of properties can be obtained. Worked in a manner similar to metal except that speeds are higher. Mechanical uses include gears, compressor rings, bearings, pump valves and piston rings, and numerous electrical applications. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

NATIONAL—Vulcanized fiber, a tough, resilient material possessing high mechanical strength and dielectric properties. Produced by chemically treating cotton cellulose. Made in two primary forms, sheets and tubes, from which all other shapes are made. Two principal grades, hard fiber for electrical and mechanical purposes, and flexible fiber for valves, gaskets, packing and washers. This material is to a considerable extent plastic, especially when heated and may be pressed into many simple shapes which do not require too much distortion. National Vulcanized Fibre Co., Wilmington, Del.

OHMOID—A laminated phenolic material characterized by its resistance and strength. Available in paper, linen and canvas grades in various colors. Suitable for a wide range of mechanical requirements. Wilmington Fibre Specialty Co., Wilmington, Del.

PHENOLIC—This composition has unusual tensile strength and takes high polish, satin or dull finish. Resistant to heat and is waterproof. Can be furnished in all colors except white, and also to match various wood finishes and mottling. American Record Corp., Scranton, Pa.

PHENOLITE—Laminated bakelite that is practically impervious to moisture. Made by impregnating fibrous material such as paper, cotton and linen with bakelite resin. Colors are black and natural (light brown), other colors available. Made in sheets, tubes and rods. Electrical properties much higher than vulcanized fiber. Can be sawed, turned, drilled, threaded, and otherwise machined. Unlimited electrical applications. Mechanically, it is suitable for silent gears and pinions, bushings, bearings, valve disks, etc. National Vulcanized Fibre Co., Wilmington, Del.

PLASKON—A urea-formaldehyde molding material possessing strength, lightness of weight, and translucency. Made in innumerable colors. Tensile strength is rated at 8000 to 13,000 and compressive strength 25,000 to 30,000 pounds per square inch. Unaffected by alcohol, acetone, oils, gasoline or other common organic solvents. Used for a wide variety of machine parts in the radio, clock, automotive, and similar fields. Toledo

Synthetic Products Inc., 2112-24 Sylvan avenue, Toledo, O.

PLASTACELE—Made from celluloid acetate, in sheets rods and tubes. Du Pont Viscoloid Co. Inc., 350 Fifth avenue, New York.

PLIOFORM—Molding resin that is a synthetic derivative of natural rubber. Resists moisture and chemical corrosion. Hard, tough and readily molded by the application of heat without the use of sulphur or sulphur-bearing ingredients. In addition to its mechanical properties, it has good electrical characteristics. Available in two grades. Goodyear Tire & Rubber Co., Akron, O.

PYRALIN—A proxylin plastic available in sheets, rods and tubes. DuPont Viscoloid Co. Inc., 350 Fifth avenue, New York.

PYROFLEX—Depolymerized colloidal resin in compound to obtain definite physical properties. This thermoplastic material is applied by dipping or in sheet form to protect surfaces of almost any size or shape from corrosion. Good dielectric properties and is a good bonding material where temperatures are not too high. Also serves as a vibration dampener. Maurice A. Knight, Kelly avenue, Akron, O.

PYROPLAX—Cold molded fireproof material. Binder and filler are inorganic, the former being a cement-like substance. The filler is a combination of asbestos and other inert ingredients. Gray white in color and has good finish. Capable of withstanding constant temperatures of 1000 degrees Fahr. Principal applications embody such parts as toaster stove resistance supports, switch and rheostat bases, magnetic switch blowout shields and switch barriers. Cutler-Hammer Inc., 1333 West St. Paul avenue, Milwaukee.

RESINOX—These molding resins and powders are improved thermo-setting plastics having unusual plasticity with freedom from flow marks. They are available in a wide range of standard colors and pastel tints and are water and alcohol proof, resistant to boiling water and dilute acids and alkalies. High torque and transverse strength and resistant to heat. Used in the manufacture of electrical and mechanical parts. Resinox Corp., 230 Park avenue, New York.

RESOGLAZ—This molding material is transparent, shock resistant, can be hot molded and does not cure. Resists water, dilute alkalies and acids, but is affected by oils. Advance Solvents & Chemical Corp., 245 Fifth avenue, New York.

REVOLITE—A laminated cloth, paper or foil having such properties as waterproofness, resistance to light oils, gases and weak acids. Used for cable wrappings, endless belts and other types of belting, diaphragms for pumps and valves, gaskets, flexible connections for pulverizers and machinery where powder is handled, and roller coverings for machinery. Bakelite Corp., 247 Park avenue, New York.

RICHELAIN — Urea - formaldehyde in choice of pleasing, nonfading colors, molded into articles as varied as toys, auto fittings, radio cabinets, electrical fixtures, etc. This tough, durable material has a high resistance to solvents, acids, oils, heat and is noncombustible. Richardson Co., Melrose Park, Ill.

RUBTEX—Molded hard rubber for all purposes. Richardson Co., Indianapolis.

SPAULDITE—Laminated phenolic material made with a base of rag paper, fine fabric or coarse canvas, the sheets being impregnated with varnish binders and subjected to high pressure under intense heat. Capable of withstanding extreme shocks and stresses. High tensile and compression strength. Resists most re-agents, acids, solvents, oils and other liquids. Available in flexible and rigid forms, in grade and thickness to meet a range of mechanical applications. Wide range of colors and finishes. Spaulding Fibre Co. Inc., Tonawanda, N. Y.

SYNTHANE — Laminated bakelite in grades to meet specific requirements. Produced in one form as a material from which to make silent gears. Combines resilience, high impact strength and long life. Unaffected by oils, moisture and mild chemical solutions. This laminated material also is bonded to rubber, combining the resiliency of rubber with the strength, rigidity and solvent-resisting properties of the associated plastic. Uses include vibration absorbing mountings for motors in electric refrigerators, washing machines, fans, etc. Synthane Corp., Oaks, Pa.

TENITE—A thermoplastic molding material made from cellulose acetate. High strength, uniform texture, stability, unusual machinability, smooth finish, high luster and wide color range are major characteristics. Supplied in molding sheet and granular form, and in any desired degree of flow. Physical properties can be varied to suit application. Available in plain and in variegated colors and in any degree of transparency. Is used for parts for business machines, refrigerators, electrical appliances, automobiles, etc. Tennessee Eastman Corp., Kingsport, Tenn.

TEXTOLITE — Laminated and molded plastics in various grades to meet specific applications. Properties cover heat resistance, good electrical characteristics, glossy and smooth finish and excellent physical properties. The various classifications embody a variety of colors and combinations. Uses include such mechanical parts as handles, knobs, supports, meter and instrument members, radio and automotive parts, gears, etc. General Electric Co., Schenectady, N. Y.

THERMOPLAX—Composed of an organic binder made from carefully selected oils and pitches in conjunction with an inorganic filler such as asbestos. Will withstand continuous temperatures of 400 to 700 degrees Fahr., depending upon the formula used. It is a cold molded product, processed under high pressures varying from 500 to 140,000 pounds, depending on the size of the piece being molded. The part then is baked and a jet black or mahogany brown piece of good finish and high mechanical and electrical strength is obtained. A wide variety of intricate mechanical parts are produced from this material. Cutler-Hammer Inc., 1333 West St. Paul avenue, Milwaukee.

THIOKOL—Synthetic oil-proof rubber in two types. Furnished in raw sheet form, corresponding to crude rubber. Material is processed like rubber and is characterized by its oil resisting properties and ability to withstand corrosion. Typical applications include various types of hose for the distillate, paint and petroleum industries, gaskets, packing, pipeline rings, diaphragms, newspaper printing blankets, etc. Thiokol Corp., Yardville, N. J.

TORNESIT — Chlorinated rubber base from which can be formulated plastics, paints, emulsions, etc. Resistant to acids and alkalies. Hercules Powder Co. Inc., Wilmington, Del.

UNYTE—Rapid cure, free flowing urea resin. Supplied in form of powder, granules, mottle or sheet stock in a complete range of light-fast translucent or opaque shades. Nonflammable; resistance to heat and water is good. Unyte Corp., 521 Fifth avenue, New York.

VICTRON—Meta styrene. Can be molded directly from the powder. Highly resistant to most chemical reagents. Naugatuck Chemical, division of United States Rubber Products Inc., 1790 Broadway, New York.

VINYLITE—A variety of resins which are odorless, tasteless, chemically inert and nonflammable. Produced as granular powders, either white and opaque or transparent and colorless. They may be compounded readily with organic or inorganic fillers and with dyes or pigments to make molding compounds of practically any color or shade. Immune to water, acids and alkalies. Machine cabinets, electrical fixtures, etc., are included in mechanical applications. Rods, sheets and tubes of these resins are available for a wide variety of uses. Carbide & Carbon Chemicals Corp., 30 East Forty-second street, New York.

VULCABESTON — Manufacture of this material involves the bonding under heat and pressure, of a mixture of refined asbestos with a scientific composition which thoroughly impregnates the fibers and forms a sheet that will withstand extreme conditions of service. Furnished as compressed asbestos sheet packing, as ring gaskets cut from the sheets, full face and other types of gaskets, pump valves, etc. Used for water at any temperature; also for use in hot and cold oils, alkali solutions of all kinds, petroleum, naphtha, acids and other destructive fluids. Colt's Patent Fire Arms Mfg. Co., Plastics division, Hartford, Conn.

VULCO—A hard rubber that resists the corrosive action of chemicals such as acids and alkali solutions and will withstand moisture. Has high insulating values and is suitable for use at both low and high voltages and frequencies. Readily molded and easily machined. Characteristics may be varied to accomplish specific results. Vulcanized Rubber Co., 261 Fifth avenue, New York.

VULCOID—A laminated fibrous base insulating material, hard, dense, pliable and strong. High electrical insulating properties and great resistance to moisture. Adaptable to practically every insulating requirement. May be easily machined, punched or formed. Not readily flammable. Continental-Diamond Fibre Co., Newark, Del.

New Machines Indicate Design Trends

SIMPLIFICATION of operation, long an aim of designers, appears to have received even more impetus by recent surveys which have disclosed a considerable shortage of skilled workmen available. While simplification has always been desirable, it is even more of an attribute to a machine when the simplifying process reduces the time necessary for the beginner to learn to operate the machine.

Included in the steps toward simpler design shown on the new machines are the further grouping of controls, incorporation of additional foolproof devices and mechanisms, provisions for completely automatic operation, and similar design expedients.

Machines recently announced in addition to those shown on the next two pages include the following, arranged by fields of application:

Canning

Twelve-Valve Syruper,
Ayars Machine Co.,
North Salem, N. J.

High Vacuum Pump,
Worthington Pump & Machinery Corp.,
Harrison, N. J.

Chemical

Ammonia Dissociator,
Ajax Electric Co.,
Philadelphia.

Continuous Emulsifier,
Mixing Equipment Co.,
Rochester, N. Y.

Construction

Leaning Wheel Grader,
J. D. Adams Co.,
Indianapolis.

Domestic

Electric Refrigerator,
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

Electric Refrigerator,
Leonard Refrigerator Co.,
Detroit.

Air Filter,
Davies Air Filter Co.,
New York.

Foundry

Burnishing Barrel,
N. Ransohoff Inc.,
Carthage, O.

Industrial

Air Filter,
American Foundry Equipment Co.
Mishawaka, Ind.

Centrifugal Sand Pump,
Allen-Sherman-Hoff Co.,
Philadelphia.

Paint Spray Gun,
Binks Mfg. Co.,
Chicago.

Gasoline Powered Plant Trucks,
Howell Industrial Trucks,
Cleveland.

Self-Contained Stoker,
Combustion Engineering Co.,
New York.

Ventilating Fan,
Marathon Electric Mfg. Corp.,
Wausau, Wis.

Electric Heater,
Electric Air Heater Co.,
Mishawaka, Ind.

Power Pump,
Worthington Pump & Equipment Corp.,
Harrison, N. J.

Metalworking

Electric Metal Heater,
American Car & Foundry Co.,
New York.

Automatic Screw Machines,
National Acme Co.,
Cleveland.

Heavy Duty Roll Grinding Machine,
Farrel-Birmingham Co. Inc.,
Ansonia, Conn.

Rotary Shears,
Quickwork Co.,
St. Mary's, O.

Electric Hand Grinder,
Skilsaw Inc.,
Chicago.

Mining

Magnetic Concentrator,
Magnetic Mfg. Co.,
Milwaukee.

Moving Picture

16-mm Projector,
Bell & Howell Co.,
Chicago.

Municipal

Nonclogging Type Pumps,
Victor Equipment Co.,
Los Angeles.

Office

Transcribing Machine,
Dictaphone Sales Corp.,
New York.

Automatic Feed Duplicator,
Weller-Mundorf Co.,
Los Angeles.

Rotary Stencil Duplicator,
Speedprint Duplicator Co.,
Chicago.

Package Scale,
Hanson Scale Co.,
Chicago.

Paper

Dry Stencil Coating Machine,
General Display Works,
New York.

Power Plant

Underfeed Stoker,
Detroit Stoker Co.,
Detroit.

Printing

Type Surfacer,
Ludlow Typograph Co.,
Chicago.

Router and Type High Planer,
Hammond Machinery Builders Inc.,
Kalamazoo, Mich.

Stereotype Cutter Grinder,
Hisey-Wolf Co.,
Cincinnati.

Hydraulic Matrix Press,
Lake Erie Engineering Corp.,
Buffalo, N. Y.

Textile

Shearing Machine,
Hermas Machine Co.,
Hawthorne, N. J.

Welding

Arc Welder,
Ideal Electric & Mfg. Co.,
Mansfield, O.

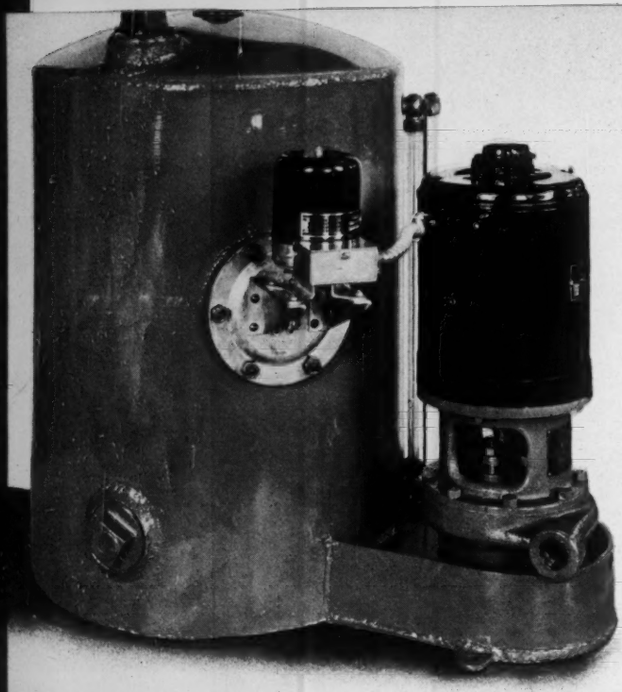
Woodworking

Portable Routing Machine,
Chicago Wheel & Mfg. Co.,
Chicago.

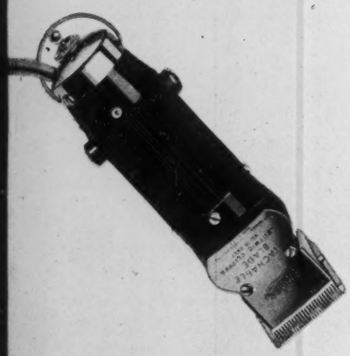
Bench Type Sawing Machine,
W. B. & J. E. Boice,
Toledo, O.

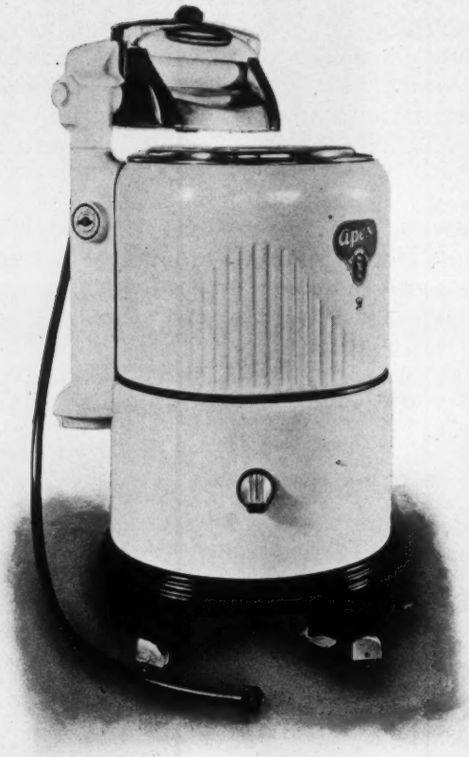
Design Features in New Machines

A Pictorial Presentation of Recent Machinery from the Standpoint of Design.

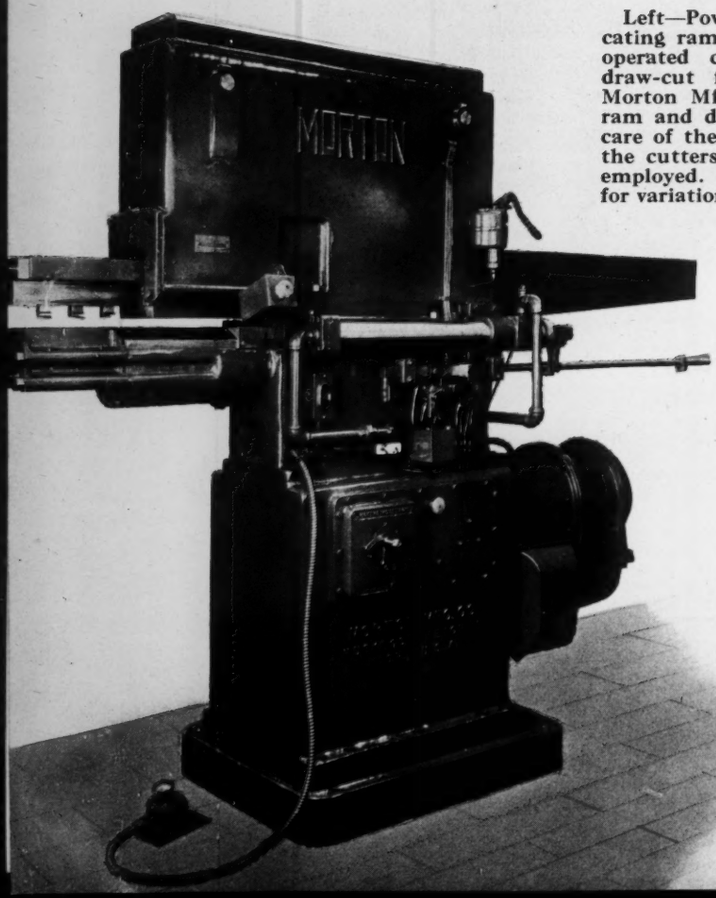


Above—Automatic operation of condensation units of American Steam Pump Co. is accomplished by means of a float and switch. The pumps are fitted with bronze impellers of the enclosed type. Receivers are of steel with all joints welded. Left—Universal motor-driven hair clipper of John Oster Mfg. Co. has case of molded Bakelite, etched to provide a firm grip. A fan on the motor combats heating, while vibration is overcome by balancing of the parts. Sanitation is enhanced by provision of an easily detachable blade.

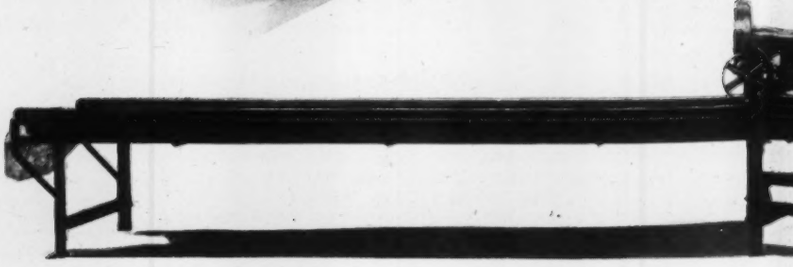




Left—Agitator action of the new Apex Rotarex Corp. clothes washer is controlled by a convenient foot pedal located just above floor level. Washing period may be set automatically by a timer attached to the wringer column. Below—All internal parts of this vertical bag fastener are cadmium plated to prevent rusting. These internal parts are made from cold rolled or cold drawn steel. All operating parts of the machine, made by Bates Mfg. Co. are cyanize hardened for long life. Malleable iron is employed for the frame castings.



Left—Power is applied to two reciprocating rams by means of hydraulically-operated cylinders in the high-duty, draw-cut flash trimming machine of Morton Mfg. Co. Vertically adjustable ram and dies which automatically take care of the clamping and positioning of the cutters in relation to the work are employed. The mechanism compensates for variations in stock thickness.



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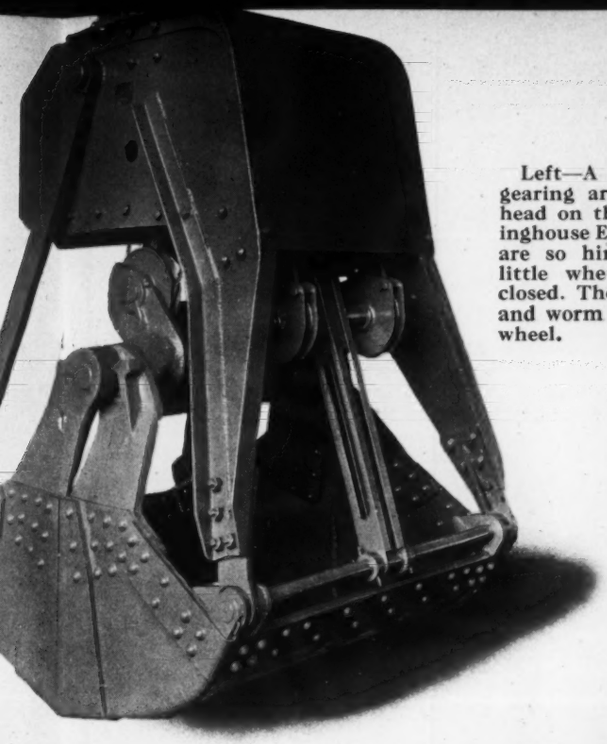

Left—A crane motor, brake and gearing are built into the bucket head on this grab bucket of Westinghouse Electric & Mfg. Co. Scoops are so hinged that height varies little whether they are open or closed. The coupling between motor and worm gear serves as a braking wheel.

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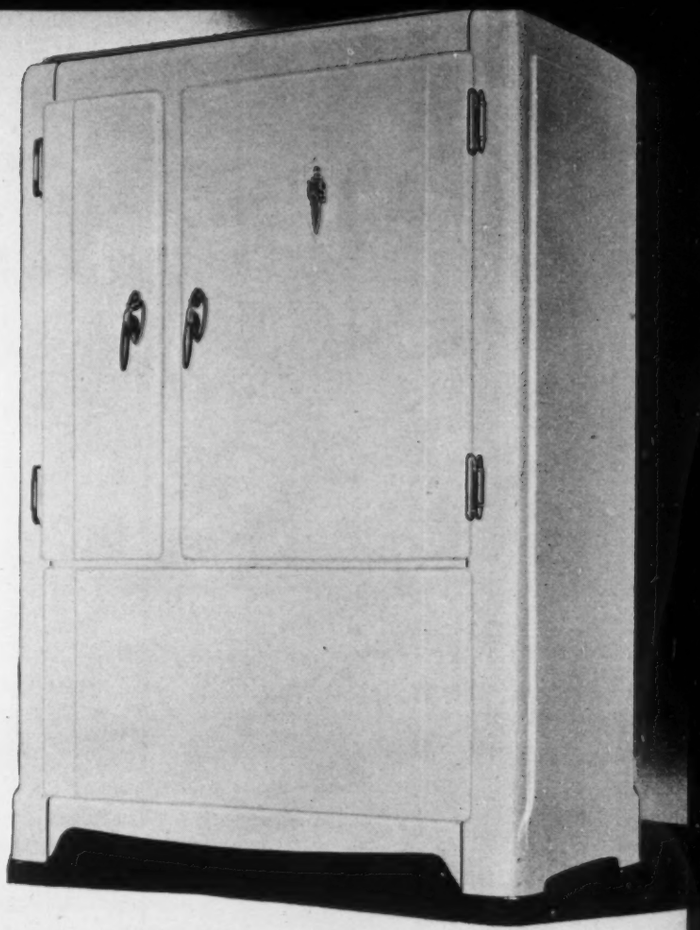
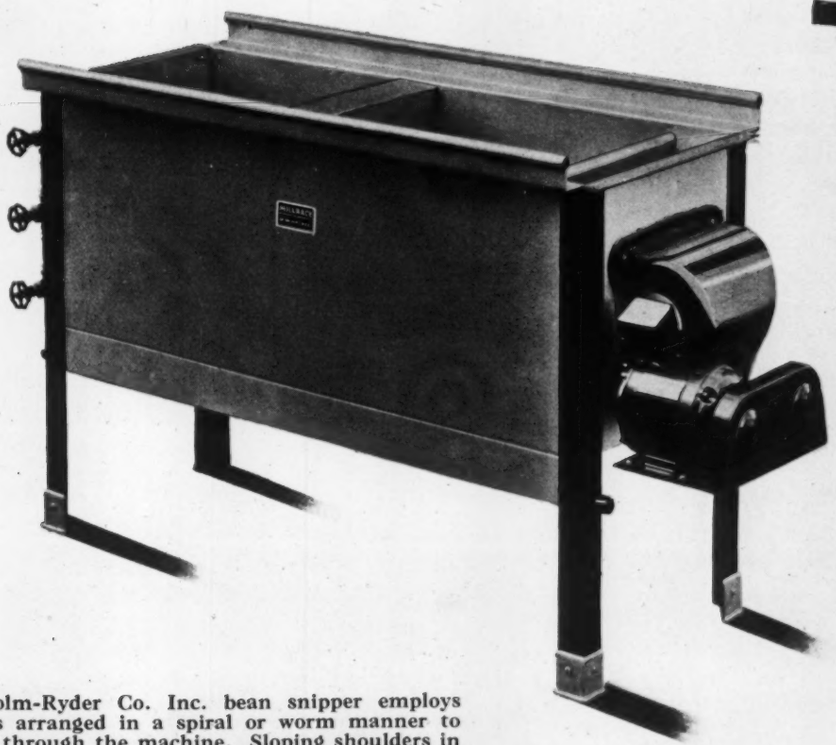
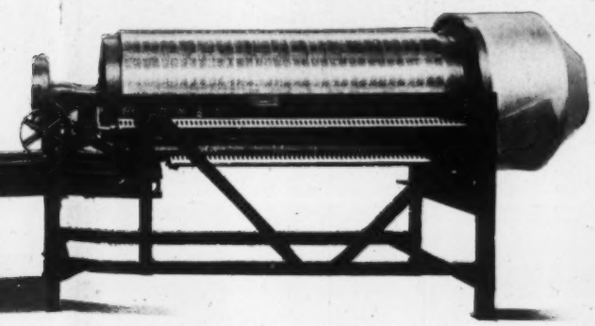


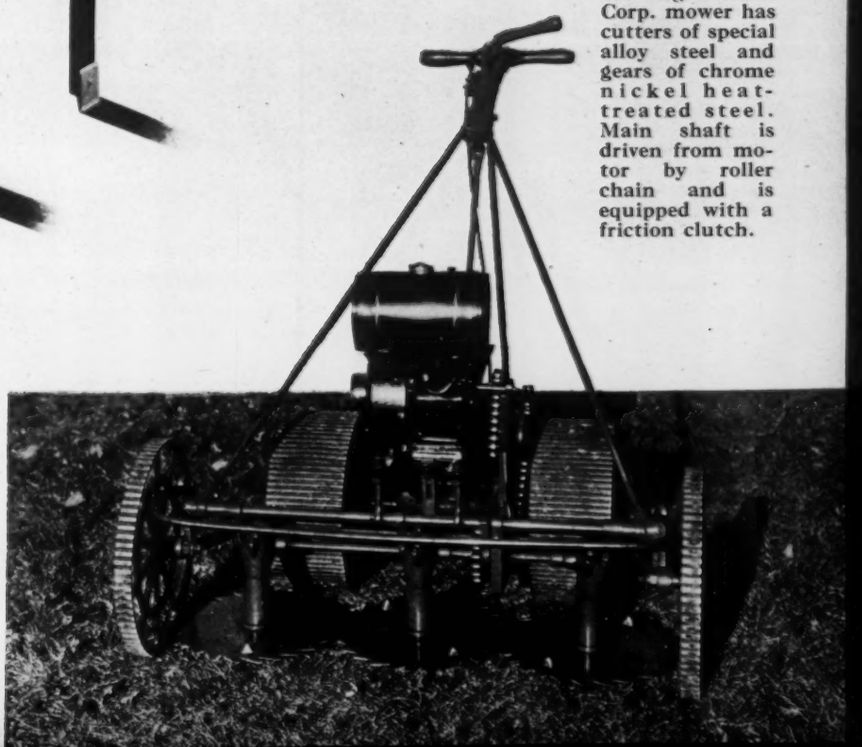


Above—Customer acceptance is emphasized in the new super deluxe Kelvinator refrigerators which include dishes on a revolving wheel to permit easy selection. Crispers are fitted with flat covers of composition material that may be used as trays. Left—Tanks of commercial dishwasher are available of galvanized iron, copper or stainless metal to suit the choice of the purchaser. Driving motors are fitted with thermal cutout switches as a protection against overload. Correct water level in the tank is maintained by an equalizer. Built by Bernard Gloekler Co.

Below—Chisholm-Ryder Co. Inc. bean snipper employs cast pockets arranged in a spiral or worm manner to ry the beans through the machine. Sloping shoulders in pockets automatically guide the beans into aperatures ough which the ends protrude and are sheared off.



Below—Standard Mfg. & Sales Corp. mower has cutters of special alloy steel and gears of chrome nickel heat-treated steel. Main shaft is driven from motor by roller chain and is equipped with a friction clutch.



MACHINE DESIGN

Are You Prepared for Possible Flood of Machinery Orders?

INVESTIGATION of the potential market for new machinery to replace obsolete models proves that an overwhelming flood of orders is dammed up awaiting better conditions. Prior to 1930, industry absorbed eight billion dollars worth of new machines annually; since then the volume has dropped to two billions. Given improved business in general, indications of which can be seen on every hand, many machinery builders may find themselves wholly incapable of meeting the demand. Already the foundry equipment field—to instance only one—is approaching that condition.

A survey that may prove of material assistance to machinery builders is being undertaken by the Machinery and Allied Products Institute. Its purpose is to obtain from members of the institute and also other producers and users of machinery, estimates of the replacements of machinery, or additional machines, that would be needed if conditions were to become more normal. Returns thus far received show that many firms have potential requirements exceeding $200,000; one company reports requirements of a million and another two million dollars value!

One way in which the machinery industry can help itself is to support this survey. Another, to check its results. Preparedness will repay the companies most alert to the possibilities ahead.

• • •

Metallic or Nonmetallic?

FOR many years engineers have considered plastic materials as being suitable only for ornamentation or insulation. Originally these were their primary functions, but that day is passing. With the progress which has taken place in plastics they now are being employed in the production of parts of many different types of machines. Application to other units, now under development, indicates even wider acceptance and use.

This is the reason MACHINE DESIGN has compiled the directory of plastics appearing on pages 34, 35, and 36. For the first time a complete listing of domestic materials of this type is presented to the design field, with the intention of following it up in a subsequent issue with a directory covering other classes of nonmetallic materials used in design of machines.

These directories, as well as the directory of iron, steel and nonferrous alloys, are the machine designer's guide to materials. They represent many hours of labor in collection and compilation of data. MACHINE DESIGN'S staff feels gratified by the reception of the field and the number of requests received for extra copies.

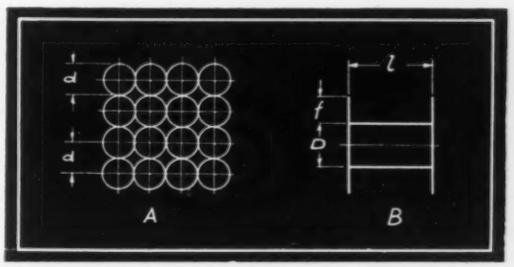
PROFESSIONAL VIEWPOINTS

Machine Design Welcomes Letters Suitable for Publication

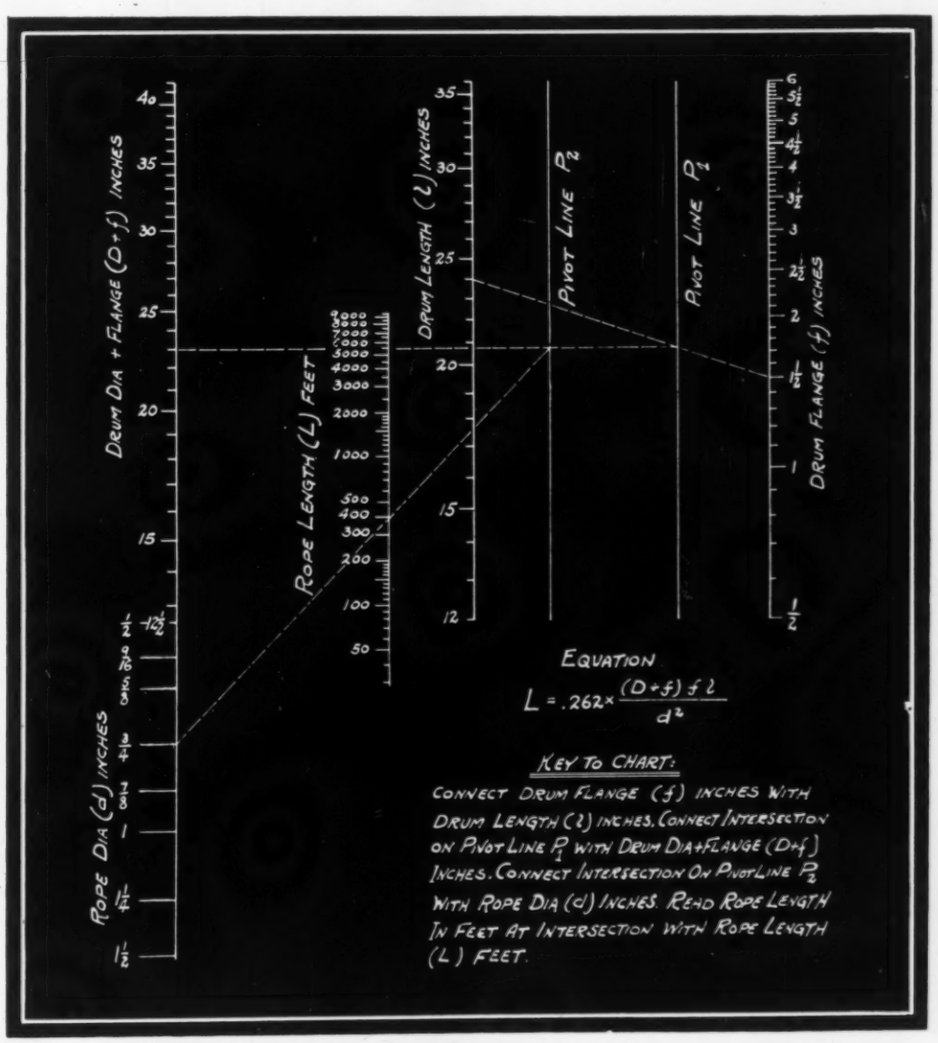
Determining Rope Drum Capacity

To the Editor:

MAY I submit the derivation of a formula for rope drum capacity? The problem is to find an analytical expression for the length of rope that can be wound on a cylindrical drum with the flanges perpendicular to the drum barrel. A rope drum capacity nomogram chart prepared from these formulas is presented herewith. In the accompanying illustration, *A* shows the general lay of the indi-



Formulas for rope drum capacity are based on lay of rope on the drum


DRUM DIA + FLANGE (D+f) INCHES
ROPE LENGTH (L) FEET
DRUM LENGTH (l) INCHES
PIVOT LINE P2
PIVOT LINE P1
DRUM FLANGE (f) INCHES
ROPE DIA (d) INCHES
EQUATION
L = .262 × (D+f) f l / d²
KEY TO CHART:
CONNECT DRUM FLANGE (f) INCHES WITH DRUM LENGTH (l) INCHES. CONNECT INTERSECTION ON PIVOT LINE P1 WITH DRUM DIA+FLANGE (D+f) INCHES. CONNECT INTERSECTION ON PIVOT LINE P2 WITH ROPE DIA (d) INCHES. READ ROPE LENGTH IN FEET AT INTERSECTION WITH ROPE LENGTH (L) FEET.

vidual rope sections on the drum. In B the flange height f and the drum length l are assumed to be an even multiple of the rope diameter d. The rope is assumed to lay around the drum in concentric circles on top of each other and side by side.

The length of n radial coils is:

$$L_n = \pi(D+d) + \pi(D+d+1\times 2d) + \pi(D+d+2\times 2d) + \ldots\ldots + \pi[D+d+(n-1)\times 2d]$$

$$n-1 = (f-d)/d \quad \therefore n = f/d$$

$$L_n = (n/2)\left[\pi(D+d) + \pi\left\{D+d+(n-1)2d\right\}\right] =$$

$$(f/2d)\left[\pi(D+d) + \pi\left\{D+d+2d(f-d)/d\right\}\right] = \pi\,(D+f)f/d$$

The number of m axial coils is expressed by:

$$m = l/d$$

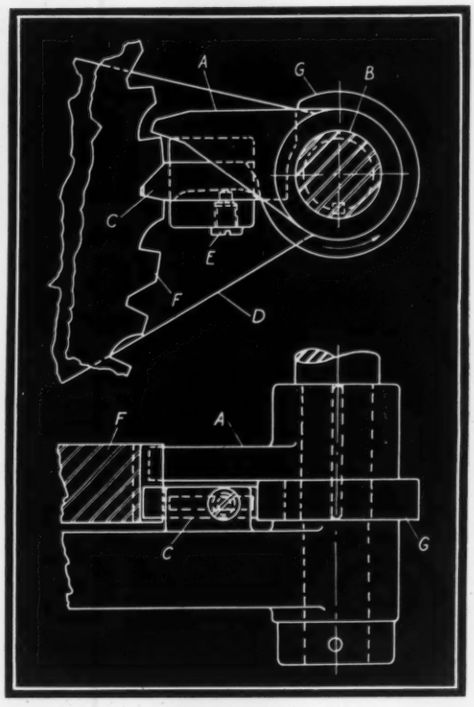
Total length, L, of n radial and m axial coils can be determined by the following formula:

$$L = L_n \times m = \pi(D+f)fl/d^2$$

To get L expressed in feet when D, d, f and l are in inches, divide by 12:

$$L_{feet} = 0.262(D+f)fl/d^2$$

—Bruno L. Lonngren,
Bucyrus-Erie Co



Dial itself operates simple locking plunger in indexing mechanism

Simplifying Indexing Devices

To the Editor:

SIMPLICITY in design is exemplified by the mechanism shown herewith. It is used for indexing the dial of a screw slotting machine. Instead of an expensive locking arrangement, the dial itself operates the simple locking plunger. This mechanism consists merely of indexing arm A keyed to constantly rotating shaft B, and locking plunger C confined in a slot in machine frame D by shoulder screw E. Notches cut in the periphery of dial F correspond to the stations. Cam G is also provided for permitting the release of the locking plunger and re-engaging it with the dial.

As the shaft rotates in the direction of the arrow, arm A, in contact with one of the dial notches, rotates the dial a distance equal to that between two notches. While this movement is taking place, the low part of cam G is opposite the end of the locking plunger, thus allowing the beveled part of the notch to force the plunger out of engagement with the dial.

As soon as the arm has moved the dial to its next station, the gradual rise in the cam forces the plunger into the succeeding notch, thus locking the dial. The dial then dwells until the arm has rotated into position for the next indexing movement. With this arrangement, the dial is indexed in practically one-eighth revolution of shaft B. Consequently an unusually long dwell is provided for performing the slotting operation.

—J. E. Fenno,
Belleville, N. J.

Bearing Charts Were Transposed

In the article entitled "Bearing Analysis Determines Permissible Speeds," by William A. Rowe, published on page 30 of the January issue of Machine Design, the charts indicated as *Figs.* 2 and 3 were transposed; the caption marked *Fig.* 2 refers to the chart shown as *Fig.* 3, and vice versa. The speed of the journals referred to in the article on page 31 was maintained constant at 10, 20, 30 and 40 feet per second.

"We have heard a lot during the last few years about the engineering method of approach to any problem, but it seems to me that while the engineering method may be entirely clear to the engineering fraternity it has seldom been expounded in layman's language. In fact, when we get down to bed-rock in the matter we find that there is no difference between the engineering approach and logical business procedure, because that procedure in both cases is: Get the facts; interpret facts into trends; from trends, formulate policies; and effectuate policies by action."—R. E. W. Harrison.

TOPICS

A SURVEY of potential machinery requirements conducted by Machinery and Allied Products institute among members comprising some 900 machinery manufacturers, is disclosing some mighty interesting facts. Reports so far received show that the industry would purchase, were there an indication of sound governmental policy and restored confidence— and of course providing financial requirements were or could be made available— machinery totaling millions of dollars. Many firms indicate requirements in excess of $200,000; one would spend in excess of $1,000,000, and another needs 2,000,000 dollars worth of equipment. Is this not proof that an overwhelming flood of machinery orders is dammed up?

* * *

Claims Inventors Are Over-Enthusiastic

Dr. L. Autzinger, business managing chairman of an organization calling itself the International Union of Inventors, makes a statement that reflects a condition long recognized in this country. In an article he has written for *Die Umschau* it is pointed out that, of the 700,000 patents granted annually in the world only a small number are of any commercial value. Amateurishness on the part of the inventors, inability to appraise industrial needs correctly, general ignorance of what has been done in the past in similar fields, are responsible for this poor showing, he says.

* * *

Planetarium Is Engineering Feat

Engineering has played an important role in the construction and equipment of the new Hayden Planetarium of the American Museum of Natural History undergoing completion in New York City. Dr. Clyde Fisher, head of the department of astronomy of the museum, declares that although the room is entirely enclosed, visitors will have the feeling of unlimited space. This effect, he explained, has been achieved by the use of rock cork, the function of which is to eliminate all reverberations and echoes and deaden sounds so that with the lights out human ears will not be able to sense the presence of walls. In the center of the room will stand a Zeiss projector built with the accuracy of a watch. It will project on the dome of the structure a photograph of every celestial object visible to the unaided eye.

* * *

Accidents Set New Record

Nineteen thirty-four saw all accident fatalities rise from 91,087 as of 1933, to 99,000, thus approximating the all-time high record of 99,300 deaths established in 1930. Last year's occupational accidents claimed 15,500 lives, it is estimated, or 1000 more than in 1933. These occupational deaths, however, were far outstripped by increases in motor vehicle and home fatalities. Motor vehicle deaths rose to 35,500, a gain of 13 per cent, to set a new record in highway slaughter.

* * *

Russia May Lead Aluminum Output

Expansion in the face of possible reduced prices may reflect confidence that low prices and active competition will translate aluminum's enormous potentialities into active demand. Thus concludes an engaging sketch of the aluminum industry's activities, in Arthur D. Little's *Industrial Bulletin*. With Bohn Aluminum & Brass Corp. announcing its plans to erect a plant for the manufacture of aluminum from alunite (M. D., Nov., p.50), problems facing the industry have been given renewed emphasis. That price cuts may occur is foreshadowed by the many new plants recently built, now under construction or projected in Russia, Japan, Italy, India, the United States and elsewhere, despite heavy existing over-capacity, the bulletin states. Another significant development is Russia's

progress whereby it has stepped in two years from negligible importance to perhaps second place in the aluminum world and bids fair to equal present production of all other countries by 1937.

* * *

Publishes Color Dictionary

Since color is playing a larger part in engineering, the designers of machinery will be interested in this item from Great Britain. A new dictionary of colors, consisting of two volumes, has been published by the British Color council. One contains 220 silk ribbons each distinctively colored, named and tabulated; the other presents the history of each color.

* * *

Engineers Deserve High Praise

Honest, these engineers! The Harmon Foundation of New York which loans money to deserving students reports that engineers and teachers have, thus far, had the best record of repayment, the former showing by all odds the most punctual and clear-cut performance.

* * *

Mammoth Wind Tunnel Erected

At Langley Field, Virginia, the national advisory committee for aeronautics has erected a huge wind tunnel embodying engineering features that have incited considerable comment. The tunnel is of the double-return flow type with a thirty by sixty-foot open jet at the test section. Air is circulated by two propellers thirty-five feet five inches in diameter, located side by side and each directly connected to a 4000 horsepower alternating current slip-ring induction motor. Motor control equipment permits varying the speed in twenty-four steps between 25 and 118 miles per hour. The tunnel is equipped with a six-component balance for obtaining the forces in three directions and the moments about the three axes of an airplane. All seven dial scales of the balance system are of the recording type, which permits simultaneous records to be made of all forces.

* * *

A Basic Step in Studying Accidents

Under the title "Standard Method to Determine Causes of Industrial Accidents," the official organ of the American Standards association announces that a committee is working on a "cause code" as a basic step in studying how accidents occur. Heads in the revised code coincide with the natural sequence of events and circumstances that constitute an accident. They are: An unguarded machine or other mechanical or physial hazard and/or the unsafe act of a person; the fall of a person or other type of accident, resulting in injurious contact with the machine, object or other agency. The revised code, although it is more complete than existing codes, is not complex or difficult to use.

* * *

Engineers Cool Dam Gradually

Few probably realize that Boulder Dam is the largest mechanical refrigerator in the world. Because cement generates heat when it sets, engineers have taken steps to make this 6,500,000-ton block of concrete set gradually without developing dangerous cracks. It is estimated that normally two hundred years would be required to cool it. So just before pouring the concrete coils of pipe were laid in the dam. This pipe, measuring 530 miles, forms the largest cooling coil ever constructed.

* * *

Recommends "EP" Lubricants

Extreme pressure lubricants are in the public eye again. Ford made known recently that this type of gear lubricant had been adopted as standard for the rear axles of V-8 cars and trucks. The announcement states that the Ford company now is conducting an extensive research as are also the Society of Automotive Engineers and oil companies in order to establish standard specifications for the lubricants for protection of the public. In the rear axle of the V-8 cars and trucks a somewhat milder "EP" lubricant is used than is required for heavy industrial machinery.

* * *

Watch Railroad Design Progress!

High spots in current railway development: New York Central places a streamlined engine in service; Boston & Maine railroad follows suit with first of five streamlined steam locomotives brought from Lima Locomotive Co.; Chicago, Milwaukee, St. Paul & Pacific orders two streamlined steam engines of advanced design from American Locomotive Co.; American Car & Foundry Co. ships two streamlined railway motor driven cars to Norfolk Southern railway. Southern Pacific plans to spend $1,300,000 on air conditioning its principal trains.

MEN OF MACHINES

ENGINEERING is indebted to such men as Charles Pack for notable advancement in die casting. Indicative of his long record in the industry is the fact that he read the first published paper on die castings before the American Institute of Metals in 1914.

After 18 years with the Doehler Die Casting Co. he became a consulting engineer, to which business he has devoted the past six years. Now he returns to Doehler as assistant to the president of the company in charge of research and development work.

Mr. Pack holds memberships in the American Society for Testing Materials, American Institute of Mining and Metallurgical Engineers, Society of Automotive Engineers and others. He is a member of the die casting committee of the former society.

CHARLES PACK

• • •

NOMINEES for offices in the American Institute of Electrical Engineers include Edward Barnard Meyer who is the candidate for president. He has been particularly active in the organization and is prominent in the profession.

Born in Newark, N. J., Oct. 22, 1882, Mr. Meyer received his technical education at Newark high school and at Pratt Institute where he graduated in electrical engineering in 1903. The same year he entered the employ of the Public Service Corp. of New Jersey, remaining until 1922. With the formation of the Public Service Production Co. in that year he was made chief engineer.

In 1929 Mr. Meyer assumed the office of vice president and in 1930 when the company was merged with United Engineers & Contractors Inc., he became the engineering director, Newark office.

EDWARD B. MEYER

• • •

ENGINEERING is more than a profession to Harold F. Shepherd—it's a religion! His career began in 1904 as an apprentice to a firm building agricultural machinery. After almost unlimited experience, a new appointment now places him as associate engineer in the office of the resident inspector of naval material at Beloit, Wis.

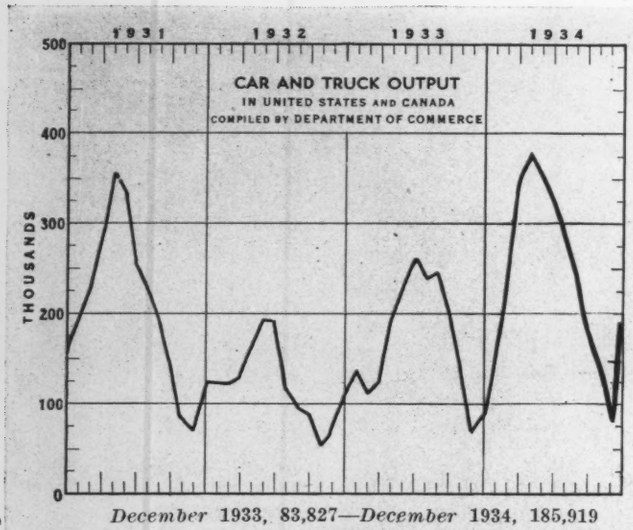
Mr. Shepherd has never ceased his quest for technical knowledge. At Philadelphia, while employed first by Otto Gas Engine Co. and later by United Gas Improvement Co., he studied machine design and physics at Drexel Institute.

Each year has added accomplishments to his name until now he holds an imposing record in design, particularly in the internal combustion engine field. In 1926, for example, he designed and

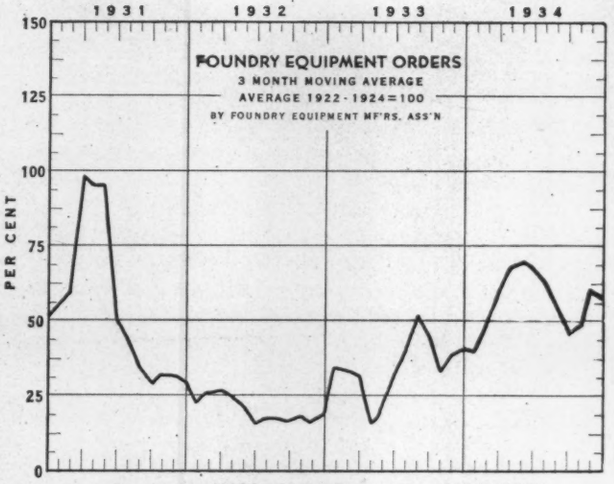
(*Concluded on Page* 64)

HAROLD F. SHEPHERD

How Is Business?



December 1933, 83,827—*December* 1934, 185,919



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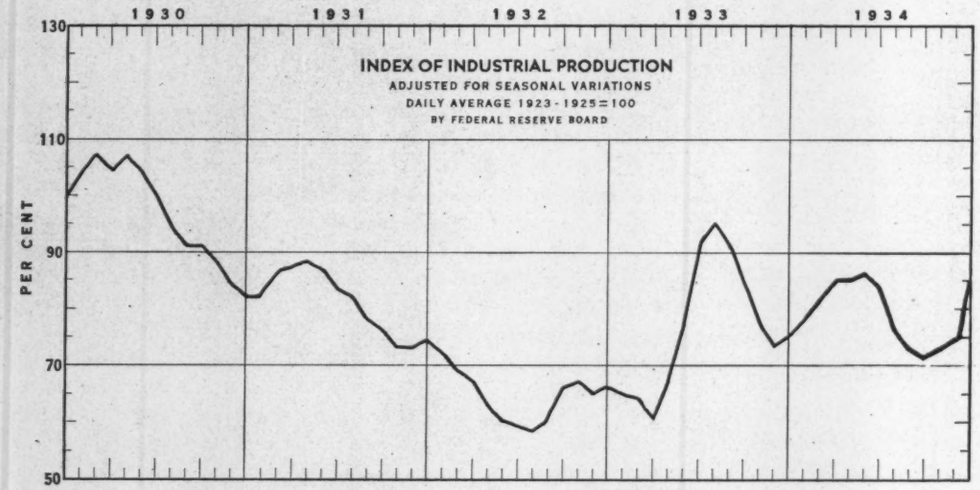
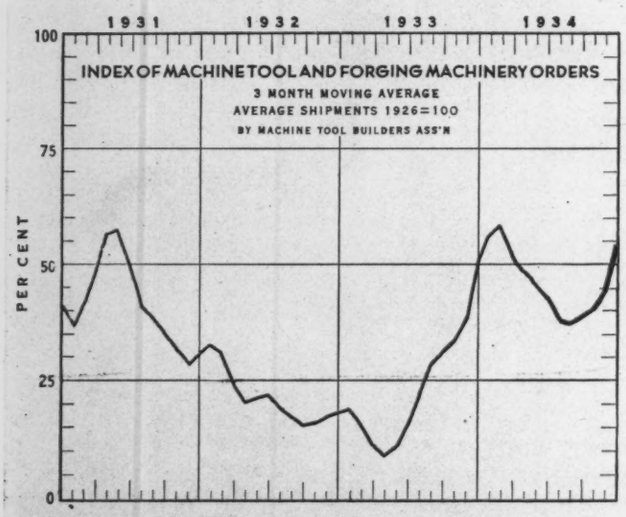


December 1933, 75—*December* 1934, 85



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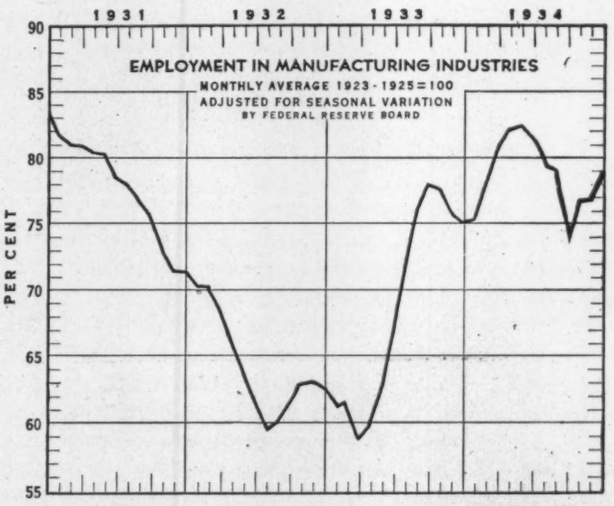


December 1933, 75.0—*December* 1934, 79.0

NOTEWORTHY PATENTS

PROPER contact pressure is maintained by centrifugal force in a variable speed transmission patented by George H. Gibson, Upper Montclair, N. J. The conical rollers employed run in a concave track, providing a long arc of

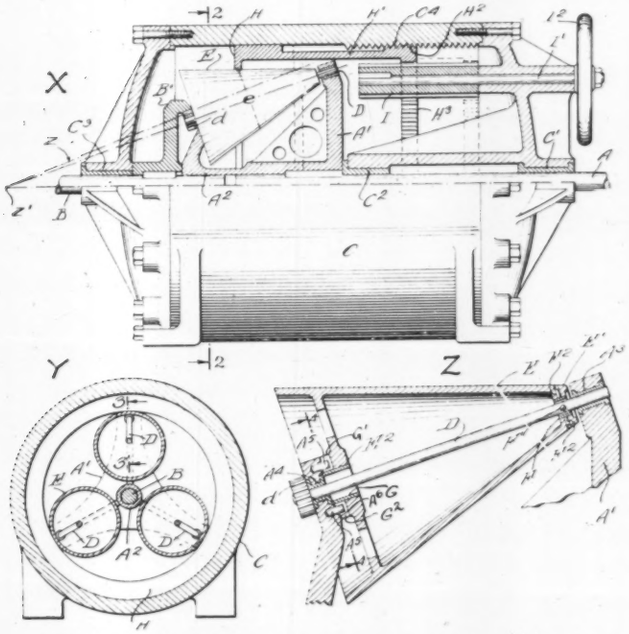


Fig. 1—Conical rollers are employed to obtain variations in speed of driven shaft

contact. Driving shaft *A*, *Fig.* 1 *X*, connected to a constant speed motor, carries a spider *A'* *Fig.* 1, *Y*, on which three cones *E* are mounted. Spindle *D* of each cone *E* is journaled in *A'*. Cone *E*, however, is not rigidly attached to spindle *D* but is suspended on a universal joint at *F*, *Fig.* 1, *Z*. The large end of the cone is journaled on bearing *G* which can slide radially on spider *A'*.

When the driving shaft is in rotation cone *E* will be thrown out by centrifugal force and will roll upon circumferential track *H*. The left end of the cone spindle carries a small bevel gear *d* which engages the bevel *B'*, the latter being keyed on driven shaft *B*. By projecting the axis of the cone spindle *D* until it intersects the axis of driven shaft *Z'* and then drawing a line from that point through the line of contact of the small bevel *d* with the large bevel *B'*, and continuing that line until it intersects the surface of cone *E*, the result is a point such that with the race *H* at that point no motion will be transmitted to driven shaft *B*.

If race *H* is moved to the right of that point shaft *B* will rotate in a direction opposite to driving shaft *A;* while if it is moved to the left, *B* will rotate in the same direction as shaft *A* and at an increasing rate as *H* is moved further to the left. If the largest diameter of cone *E* is many times the diameter of small bevel *d*, the driven shaft will move nearly as fast as the driving shaft when race *H* is at this largest diameter of the cone.

In this transmission the pressure on the frictional contact is large only when the race is near the starting point on the conical rollers, at which point, however, the greatest frictional traction is required. In other words, small cone *E*, pressing outward by centrifugal force and being pivoted at *F*, exerts a greater force against race *H* the nearer the race is to the apex of the cone.

This patent is designated No. 1,887,505.

TO PREVENT breakage of parts a clutch has been patented that will remain closed in normal operation but will open automatically if the resistance to operation of the machines

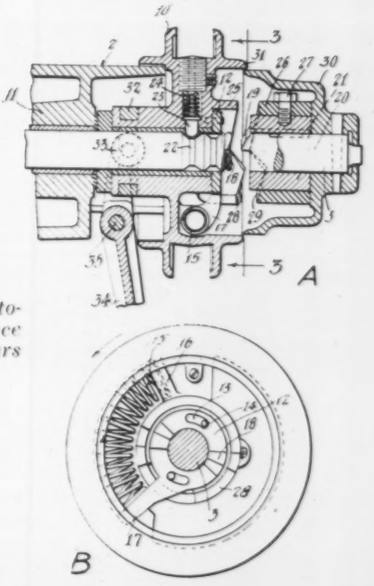


Fig. 2—Clutch opens automatically when resistance to normal operation occurs

becomes abnormally great. The inventor is William de Back who has assigned his patent to Food Machinery Corp., San Jose, Calif. Pulley 10, *Fig.* 2, *A,* is the driving member for the clutch. In operation this pulley is located in a position toward the right of that shown in drawing *A,* with driving jaws 18 and 19 of the clutch members in engagement with each other. In this position cams 25 and 26 are in proper relation to each other to permit this engagement.

Driving force from pulley 10 is imparted through spring 15 (*B*) to driving clutch member 12, this spring being maintained constantly in compression because of the connection between the pulley and the driving clutch member. If the resistance to the machinery being driven becomes abnormally great and sufficient to cause further compression of spring 15, a slight relative rotation of clutch member 12 will take place in a backward direction with respect to the direction of the drive and to cam surface 28. Thus this cam surface and cam 29 will cause pulley 10 to shift toward the left, whereupon spring-pressed pin 23 will come into line with the groove 22 in the shaft as shown in *A,* and hold the clutch open until it is again closed by operating the hand lever 34.

The patent is designated No. 1,985,242.

LUBRICATION of a vertical shaft motor is effected in a unique manner in an invention recently patented by the Ohio Electric Mfg. Co., Cleveland. Oil is fed through a wick 11, *Fig.* 3, against shaft *F* by capillary attraction. Helical groove 12 carries the oil upward to bearing *H,* while lower bearing *G* obtains its lubrication by gravity feed from the point to which the oil is delivered by the wick. By employing the combination of a "short lift" wick with the helical groove there is provided a satisfactory supply of oil to the upper bearing when the motor is running, while allowing nearly all of it to drain back into the reservoir when the motor is stopped.

Number of the patent is 1,982,937.

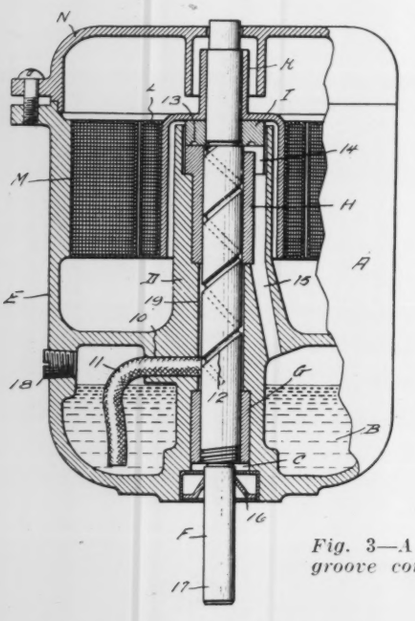


Fig. 3—A wick and helical groove conduct oil to upper bearing

COMBINATION of a screw type conveyor and coil springs has been worked out in a simple way to improve a nozzle attachment for powder filling units. This and other features are covered by a patent recently issued for the mechanism to C. J. Westin. Assignee is F. J. Stokes Machine Co. The patent is designated No. 1,981,485.

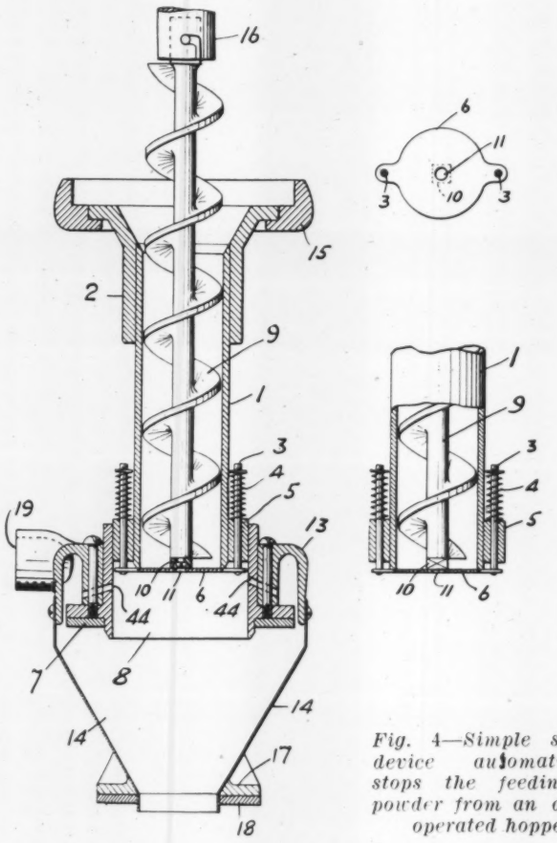
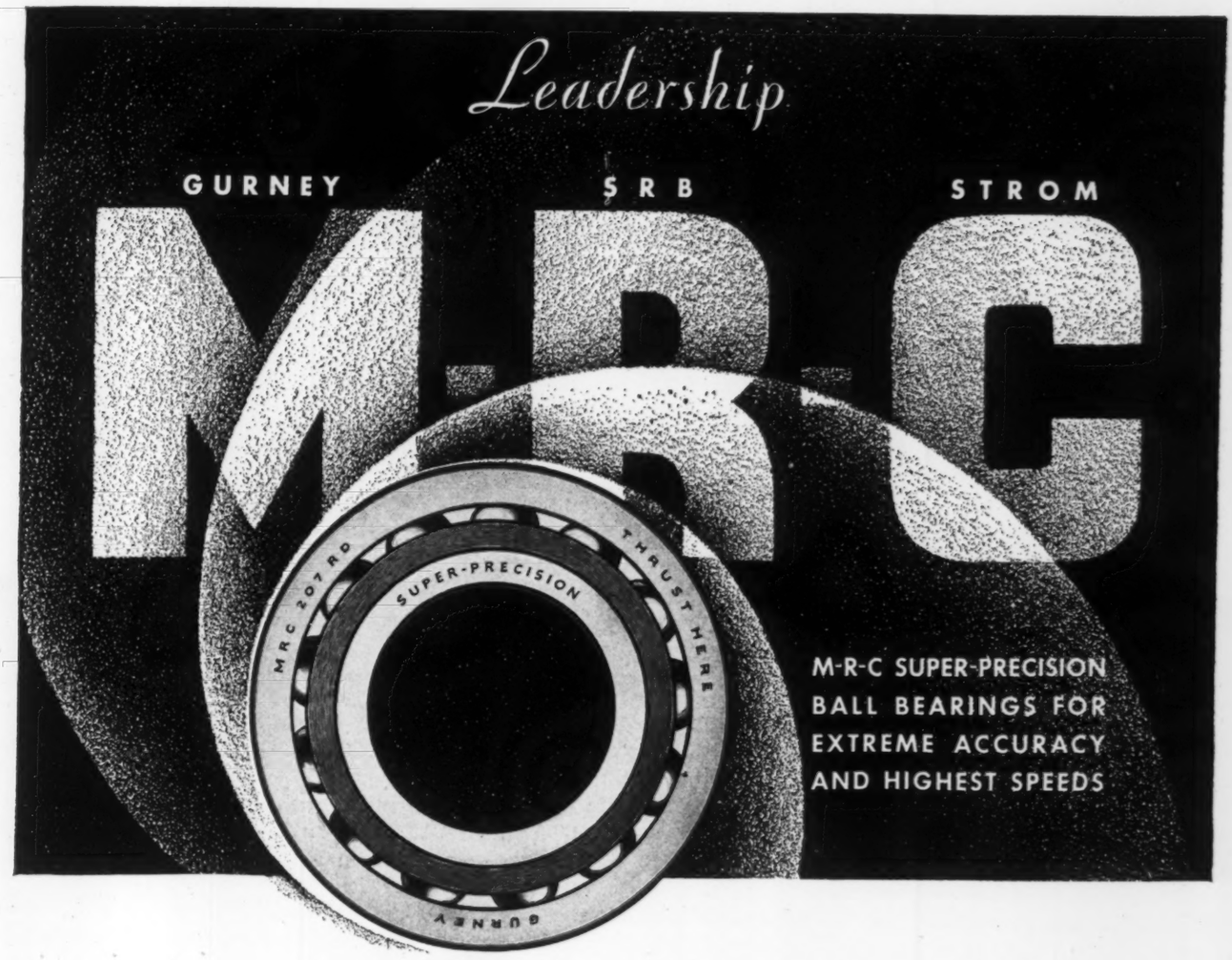


Fig. 4—Simple spring device automatically stops the feeding of powder from an auger-operated hopper

On the lower end of nozzle 1, *Fig.* 4, is attached collar 5 which has holes in it to permit guide pins 3 fastened to valve 6, to extend up through this collar so that compression springs 4 may be allowed to rest on the collar. Valve 6 is held by means of the springs against the bottom edge of the nozzle when no material is being discharged. When auger 9, held by collar 16 to the intermittently-driven operating shaft, is put in motion it draws on the supply of material from the hopper above, forcing the material down against valve 6 which yields to this pressure and allows the desired quantity of material to be discharged. Spud 10 revolving with the auger prevents material from packing between the auger and valve 6 and allows the valve to close, thereby preventing drip, instantly the auger stops.



The **Ultimate** in **Bearing Accuracy**

10,000 . . . 25,000 . . . 50,000 r.p.m. are extreme speeds that challenge the skill of every ball bearing manufacturer—a challenge accepted and proved by the performance of M-R-C Super-Precision Ball Bearings. Your product may not require the super-accuracies found in these bearings, but they do indicate the ability of M-R-C to supply your ball bearing requirements whatever they may be.

M-R-C Strom SRB Gurney Ball Bearings

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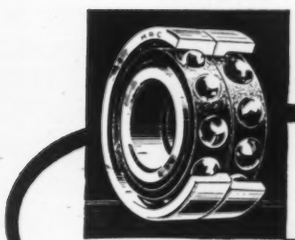


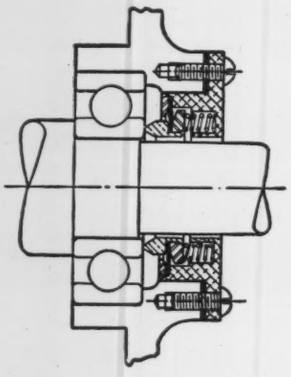
M-R-C

BALL BEARINGS

New Materials and Parts

Seals Are Designed for High Speeds

CONSTRUCTION of the new high speed oil seals produced by Gits Bros. Mfg. Co., 1857 Kilbourn avenue, Chicago, consists of a housing, diaphragm, and seal ring of special bronze. Small compression springs inserted in the housing, shown herewith, hold the seal ring in tension with the contacting face of the ball race. To avoid torsional strain on the diaphragm, all



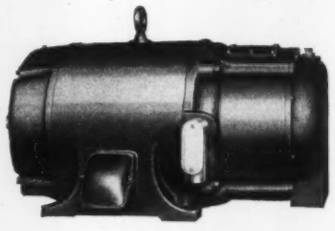
Seal ring of special bronze is employed in new high speed unit oil seal

sizes above 1-inch diameter have guide pins sliding in wells in the housing.

The diaphragm is clamped to the housing and bronze seal ring. It is of special oil and waterproof fabric similar to that used in gasoline pumps and is heat resisting up to 220 degrees Fahr. constant temperature and 275 degrees Fahr. intermittent pressure. These new seals are made in two styles, DM with flange, shown herewith, and DP without flange. A shoulder which maintains correct relationship of the seal to the bearing is required by the DP seal. The DP seal is designed for a press fit in its retainer. The advantage of the flange type over the press fit is that it can be readily removed for inspection of seal or bearing.

Develops New Splashproof Motors

SUITABLE for installations where the machine is washed down at night or at the end of the day's run or for outdoor installations, the new line of splashproof slip ring polyphase motors brought out by Century Electric Co., 1806 Pine street, St. Louis, are constructed with baffled openings in the lower part of the end bracket to admit cooling air and exclude splashing water. The bearing bracket on the drive end of the motor, shown herewith, is the same one-piece construction as used on squirrel cage splashproof motors built by the company, but the end bracket on the end opposite the drive is constructed with a gasketed covered hand hole for a convenient inspection of brushes and rings, a pipe plug for easy access to the grease plug, and a removable section covering the whole end of the bracket which protects the end assembly of the motor. This arrangement renders all parts easily accessible and splash proof. The frame and end brackets are refined gray cast iron.



Baffled openings in lower part of end brackets of motors admit air yet exclude splashing liquids

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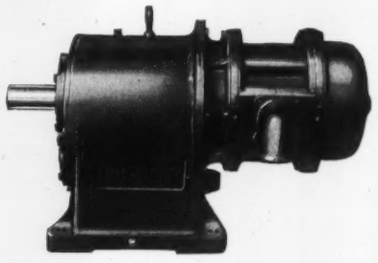
Motorized Reducers Use Helical Gears

UNUSUAL accessibility of the motor and the high speed gears is afforded in the new line of motorized gear reducers developed by Link-Belt Co., 910 South Michigan avenue, Chicago. In the new reducers, which are offered in addition to the types already being manufac-

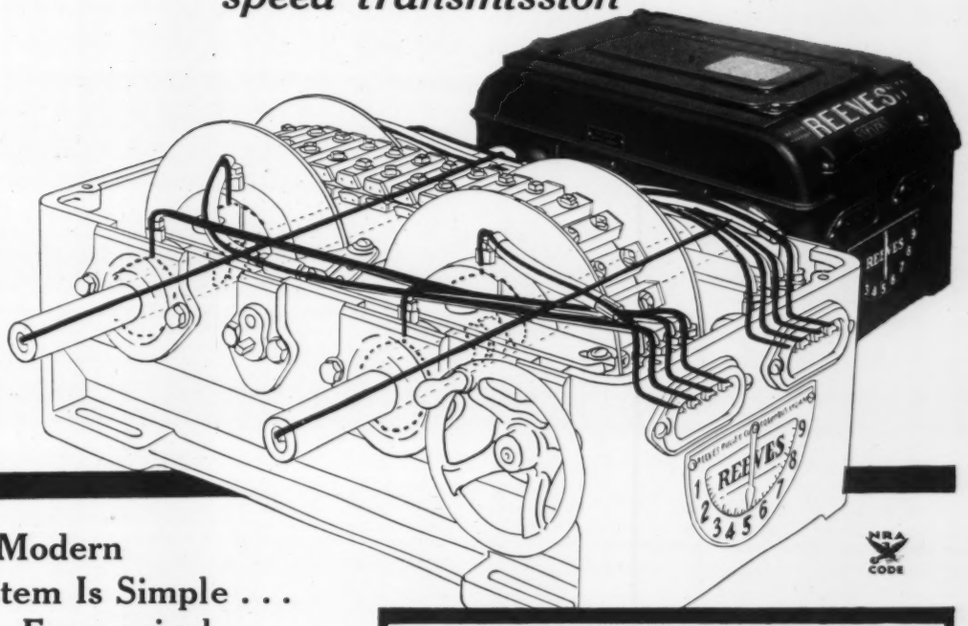


New motorized reducers may be mounted on floor, ceiling or wall. They do not require a motor base plate

Reeves Chooses ★ ★

ALEMITE CENTRALIZED LUBRICATION SYSTEM

for their famous variable speed transmission



This drawing illustrates how Reeves has adapted Alemite Centralized Lubrication System. Note that bearing surfaces are serviced by closely grouped fittings through use of rigid and flexible tubing.

This Modern Lubrication System Is Simple . . . Positive . . . Economical

● To insure adequate, positive lubrication for their famous Variable Speed Transmission—to simplify the servicing of all vital bearing surfaces—The Reeves Pulley Company has standardized on the Alemite Centralized System. Oil holes, grease plugs and cups have been entirely eliminated. It is not necessary to reach over or under any working part. Every bearing may be thoroughly lubricated without the removal of the cover section through the use of the centralized "header" arrangement of the Alemite fittings, *and the transmission can be completely lubricated while it is in operation.*

Through this simplified system of centralized high-pressure lubrication, it is now possible for any machinery manufacturer to cut lubrication and maintenance costs to a minimum. Bearings may be flushed or filled without waste of lubricant. Every bearing—plain or anti-friction—receives *individual attention.* Lubricant is delivered in *definite, measured quantities.* Remote or out-of-sight bearings are serviced without climbing or "reaching in"—for *Alemite will deliver lubricant,* under pressure, *to distances of 100 feet!* And remember: Alemite Centralized Lubrication offers *all* these features *plus* cleanliness and convenience.

Write to Alemite today. Get the full details on this modern "centralized" lubrication system and how it may be adapted to any machine. A complete staff of trained lubrication engineers is at your service. Address: Alemite Engineering Service.

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1890 Diversey Parkway, Chicago, Illinois

This man's presence in any industrial plant is immediate indication of smart maintenance management—that mechanical investments are adequately guarded by the use of modern, clean, scientifically correct lubrication methods

ALEMITE

REG. U.S. PAT. OFF.

Controlled Application of the Correct Lubricant

tured, a standard round frame motor conforming with NEMA specifications is secured to the side of the reducer housing by means of an adapter casting which supports the motor shaft in oversize antifriction bearings close to the pinion.

All gears in the unit, shown herewith, are of the helical type, with teeth cut from heat treated alloy steel. The low speed shaft and its bearings are designed to carry overhung loads. The new motorized reducers may be mounted on floor, ceiling or wall; and are available in double reduction for one-half to 75 horsepower, in ratios up to 38½ to 1, and in triple reduction up to 30 horsepower, in ratios up to 292 to 1. They do not require a motor base plate or high speed shaft coupling as the motor forms an integral part of the reducer.

Cast Iron Enclosures Are Offered

TYPE D dust-tight enclosures are now available for bulletin 709 starters in polyphase ratings as built by Allen-Bradley Co., 1311 South First street, Milwaukee, up to 15 horse-

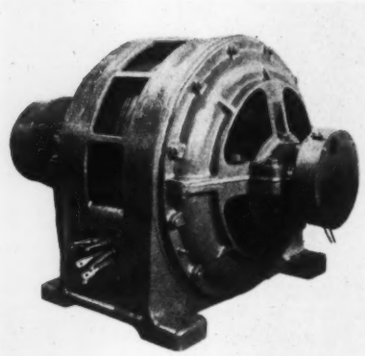
Closing surfaces are machined in cast iron enclosure to make a seal without use of gaskets

power, 110 volts; 30 horsepower, 220 volts; and 50 horsepower, 440-550 volts. These starters can also be used with single phase motors of the self-starting type.

The Type D enclosure, shown herewith, meets the Underwriters' Laboratories' requirements for Class 2, Group G hazardous locations, such as flour mills, pulverized fuel plants, etc. The enclosure is of cast iron, black enameled on the outside with a white enameled interior. Surface between the cover and base is machined, making a seal without the use of gaskets. The top and bottom of the base are tapped for threading in conduit.

Develops New Type of Electric Motor

A REVOLUTIONARY new type of electric motor, which utilizes a "stationary commutator" and has the characteristics of a series-type direct current machine but which operates from an alternating current power source, has been developed by General Electric Co., Schenectady, N. Y. Known as the "Thyratron" motor, the new development is made possible by re-



Alternating current motor has the characteristics of a series-type direct current machine

cent advances in the application of electron tubes.

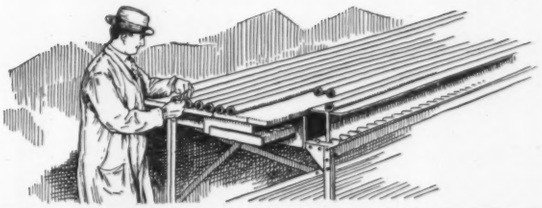
Among the features of the motor are: While running from alternating current, it has the characteristics of a series-type direct current machine; the speed of the motor is independent of the frequency of the power supply; smooth control of the speed can be obtained over the full range; in event of a momentary interruption of the supply circuit, the motor will, upon the restoration of power, start and return to the speed at which it was previously operating, without drawing excessive current from the line; and the efficiency curve though high is relatively flat, an advantage particularly in the lower portion of the speed range. Motors of this type are applicable to such auxiliaries as fans, centrifugal pumps, compressors, and similar equipment having load characteristics such that the series type of motor can be used to advantage.

Base Maintains Belt Tension

TENSION control in exact relation to fluctuations in the load is provided by the new motor base of American Pulley Co., Philadelphia.

Proper tension of belt drives is maintained by this base which adjusts for all variables

With the base properly applied, belt tension can only slightly exceed the result of the torque action, thereby eliminating the possibility of uncontrolled and excessive belt tension. Belt tension



IN STEP

"Our production schedules for the past year have necessitated some unusual demands on our sources of supply and we are taking this opportunity to let you know we appreciate what Summerill has done to keep us in step with our production no matter how difficult the assignment. You have been sensitive and intelligently responsive to every call from us."

W. K. H.

ALTHOUGH we are rather proud of our record with this customer we especially appreciate that last—

sensitive and intelligently responsive

It means a lot more than just good tubing when and where the customer wants it. It means the Summerill organization is alert and quick to sense the customer's requirements without a lot of explaining—it can quickly adjust itself to new conditions.

After all, given the experience, ability and equipment to produce a requirement, it takes human beings "intelligently responsive" to give you the material you really can use to best advantage.

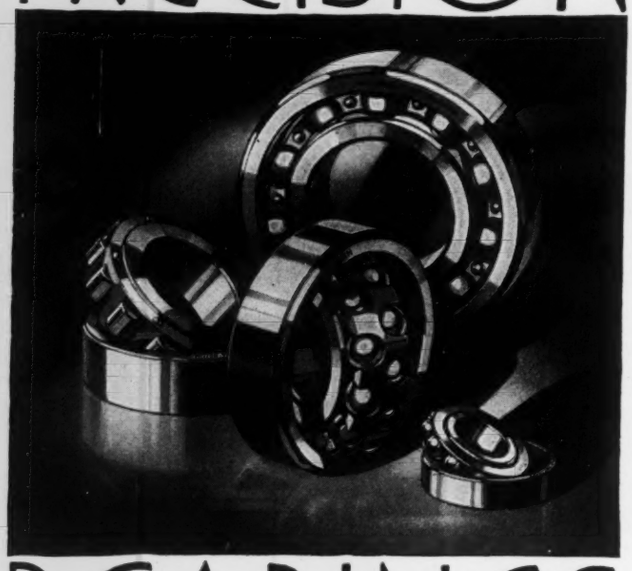
Place your tubing problems with Summerill—our engineers can help solve them.

SUMMERILL TUBING COMPANY

SPECIALISTS IN TUBING SPECIALTIES

BRIDGEPORT, MONTG. CO., PENNSYLVANIA

PRECISION



BEARINGS

PRECISION—as the term defining the characteristics distinctive of NORMA-HOFFMANN Bearings—comprehends ALL those qualities which reveal themselves in higher anti-friction efficiency, greater speed-ability, better performance, longer life, fewer replacements, improved production. ✲ ✲ ✲ These are the definite and tangible gains which accrue to the builder and user of any machine in which NORMA-HOFFMANN PRECISION Bearings are incorporated. ✲ ✲ ✲ Write for the PRECISION Bearing Catalogs. ✲ ✲ ✲ Let our engineers work with you—without obligation.

"NORMA-HOFFMANN"
PRECISION BEARINGS
BALL, ROLLER AND THRUST

NORMA-HOFFMANN BEARINGS CORP., STAMFORD, CONN., U. S. A.

controlled by reactive torque will handle intermittent loads without vibration, thus insuring a quiet drive.

In the motor base, shown herewith, all members are made of steel. The cranks supporting the cradle and motor arms are steel forgings. These are the only moving parts and they are equipped with graphite bronze bearings, requiring no lubrication. Crank bearings are of the ball and socket type. Bases are made in eight standard sizes, and other bases built to special dimensions can be made to individual specifications. The same base is applicable to floor, wall or ceiling mounting.

Introduces New Composition Material

A COMPOUND of asbestos, graphite and rubber has been introduced by Johns-Manville Corp., New York, under the name of Eel-Slip. This material is a tough but readily-machined product which has a low coefficient of friction, even though unlubricated. Water is its best lubricant. It is especially applicable as a bearing material which does not require use of the commonly employed lubricants and for applications where its mechanical strength, low coefficient of friction, and increased efficiency in the presence of moisture make it unique. In the paper industry, aside from bearings which run in water or under intermittent dry and wet service, the material is used on the wet end of Fourdrinier paper machines, as shakers or flat screen blocks, water tables or forming boards, suction box covers, steam joints, suction couch and press rolls, and deflector strips and doctor blades.

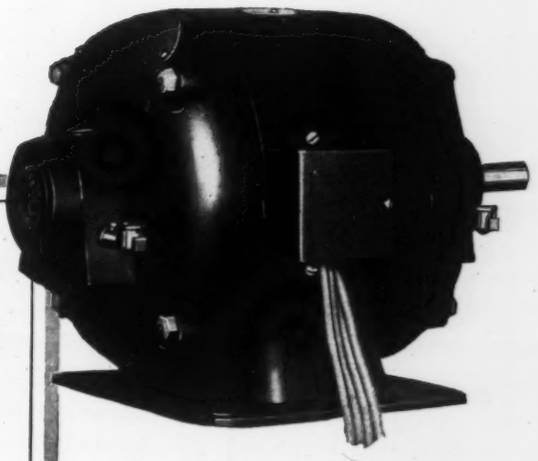
Composition material does not require usual lubricants when used as a bearing

Motors Deliver Constant Speed

CONSTANT speed is combined with the light weight and power of series universal motors in the new types of electric governor controlled motors being built by Dumore Co., Racine, Wis. Two types of governors are being offered—the adjustable type on which the speed

TO DESIGNERS WHO NEED COMPACT, RELIABLE SMALL MOTORS FOR HEAVY JOBS

General Electric Type RSA and Type SCR fractional-horsepower motors provide compact, dependable "packages of power" for jobs that require a maximum of starting and accelerating torque — applications where the machine must be started under overload starting or running conditions, or where the voltage may be low.



Type SCR (illustrated) ½ to ¾ hp. Also available in sizes through 10 hp. Type RSA 1/6 to 1/3 hp.

NRA MEMBER U.S. WE DO OUR PART

JOBS like these, for example . . .

COMPRESSORS, having a high initial starting load need the exceptional starting ability of the Type RSA and the Type SCR motors. Their output-torque curve matches the load-torque curve of the compressor — no need to over-motor.

FLOOR-SURFACING MACHINES, which are subject to heavy peak loads, due to variations in the surface conditions, and which are also subject to low-voltage conditions because of the long portable cords used. These motors were developed to meet operating conditions such as these.

SLICERS, GRINDERS, and CHOPPERS used in food-products industries, which must handle high momentary overloads and must be brought up to speed quickly. Here, again, the excellent electrical and mechanical adaptability of the Type RSA and the Type SCR makes them the RIGHT motors for the job.

Why not avail yourself of our specialized engineering service in perfecting motorized machines? General Electric, Dept. 6F-201, Schenectady, N. Y.

070-16

GENERAL ELECTRIC

★

SHAFER
self aligning
ROLLER BEARING
UNITS

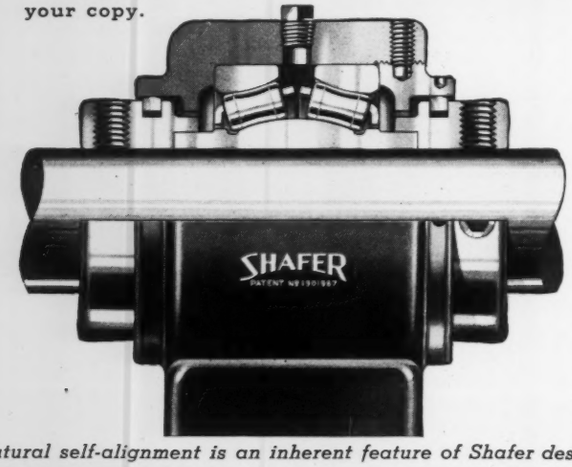
★

Extra factors of capacity, safety, and reliability for both heavy-duty and normal service are provided by the exclusive CONCAVE roller design of Shafer radial-thrust roller bearings.

Shafer stock units are complete, ready to install, offered in a full range of sizes:
Pillow Blocks • Flange Units
Take-Up Units • Hanger Boxes
Cartridge Units • Duplex Units
Conveyor Rolls

Radial-Thrust Roller Bearings

CATALOG NO. 12 gives complete data. Write for your copy.



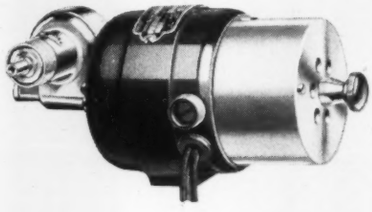
Natural self-alignment is an inherent feature of Shafer design

SHAFER BEARING CORPORATION

6513 WEST GRAND AVENUE • CHICAGO, ILL.

★

can be varied while the motor is in operation—and the fixed type which can be adjusted only when the motor is at a standstill. Three sizes each of the two types are available for controlling the speed of motors rated 1/64 to 1/8 horse-



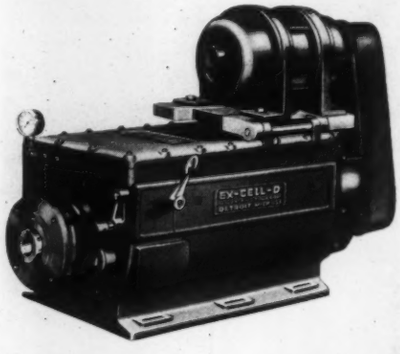
Governors supplied with series universal motors insure constant speed at all times

power over a range of approximately 1000 to 7500 revolutions per minute.

The motor shown in the accompanying illustration is type XAL, 1/25 horsepower with model CR 2-inch adjustable type governor. The line of motors is adapted for operating portable talking motion picture projectors, scientific apparatus, apparatus where quick acceleration is required, yet where constant speed under varying load is necessary. The governor also serves to hold the motor speed constant, regardless of minor fluctuations in line voltage.

Hydraulic Units Are Available

AVAILABLE in three sizes to meet all general demands, any number of the new hydraulic units manufactured by Ex-Cell-O Aircraft & Tool Co., 1200 Oakman boulevard, Detroit, or a combination of sizes can be installed on machines to permit hydraulic operation. The



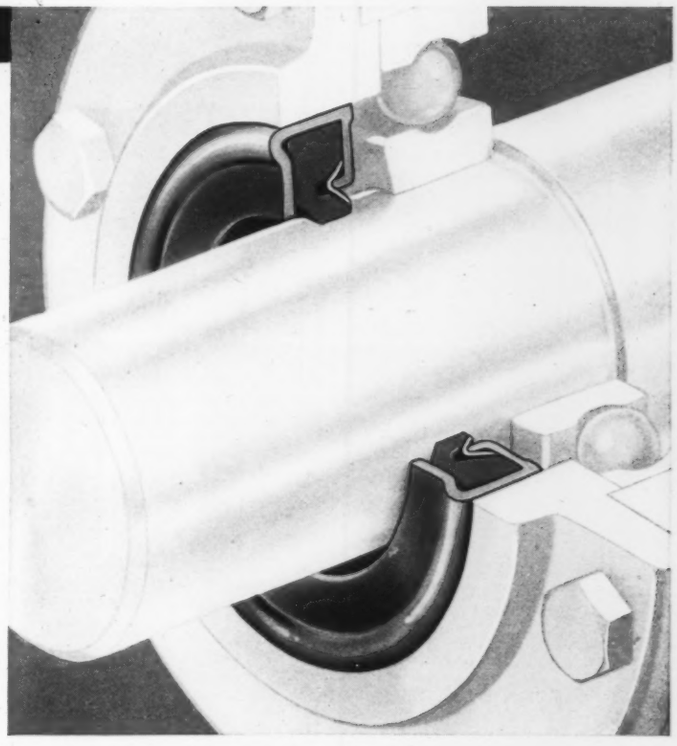
Hydraudic unit is not limited to any one position on the machine which it is to operate

unit, shown herewith, is not limited to any one position but can be mounted in a horizontal or vertical position or at any desired angle. Each of the three units is designed for a range of horsepower, depending upon the capacity required by the application.

The units have a maximum stroke of eight

PATENTED

ENGINEERS *all over the country* ASKED FOR A *BETTER* OIL SEAL



The Garlock KLOZURE is extremely simple in construction, consisting of only four parts as illustrated above.

They Now Have It—in the New GARLOCK KLOZURE

TO retain oil and grease within a bearing and to keep dust and dirt out of the bearing is essentially a *packing* job. That's why Garlock undertook the development of a truly effective Oil Seal. The result of many months of study and experimentation is the Garlock KLOZURE.

The sealing member in the Garlock KLOZURE is not leather, cork or felt. It is made from a special compound, developed in the Garlock laboratories, and molded into a shape resembling the famous Garlock Chevron packing ring.

Because of its uniform performance, its resistance to oil at high or low temperatures and its low co-efficient of friction, the Garlock KLOZURE is setting new high standards for efficient Oil Seal performance. Write for descriptive booklet.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada, Limited, Montreal, Quebec

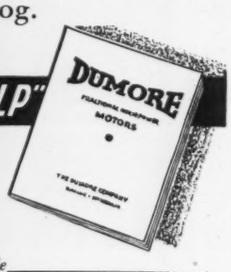
GARLOCK

IF YOU NEED HELP

DUMORE FRACTIONAL HORSEPOWER MOTORS

Don't hesitate a moment to ask Dumore for help when fractional horsepower (series wound) motors are involved. Dumore engineers have had 22 years experience in adapting as well as designing power units. Using their services doesn't obligate you.

Many sizes; power from 1/100 h. p. to ¾ h. p; voltages from 6 to 250; any speeds (through speed reducers or electric governors)—can be had in Dumore precision-built motors. And you can depend on Dumore if you must have dependability and long life. Your first step is to obtain the handy Dumore catalog. Just mail the coupon below.



APPLICATION FOR "HELP"

THE DUMORE CO., Dept. 125-B
Racine, Wis.

Kindly send me your latest catalog of Dumore fractional h. p. motors.

*Name*_____ *Title*_____

*Firm Name*_____

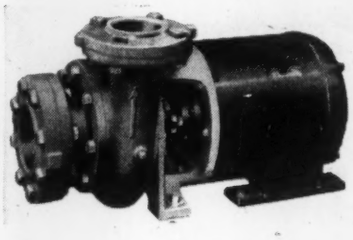
*Address*_____

*City*_____ *State*_____

inches on the small unit, ten inches on the medium unit and twelve inches on the large unit. They are all adjustable for length of stroke, length of rapid traverse and length of feed, by adjusting movable dogs that are accessible from the outside of the unit. Feed rates are controlled by feed control valves.

New Pumps Are Close Coupled

COMPACT, close-coupled centrifugal pumps of high efficiencies with capacities ranging from 100 to 600 gallons per minute against heads up to 189 feet have been added to the line of pumps being manufactured by Chicago Pump Co., 2336 Wolfram street, Chicago. The new



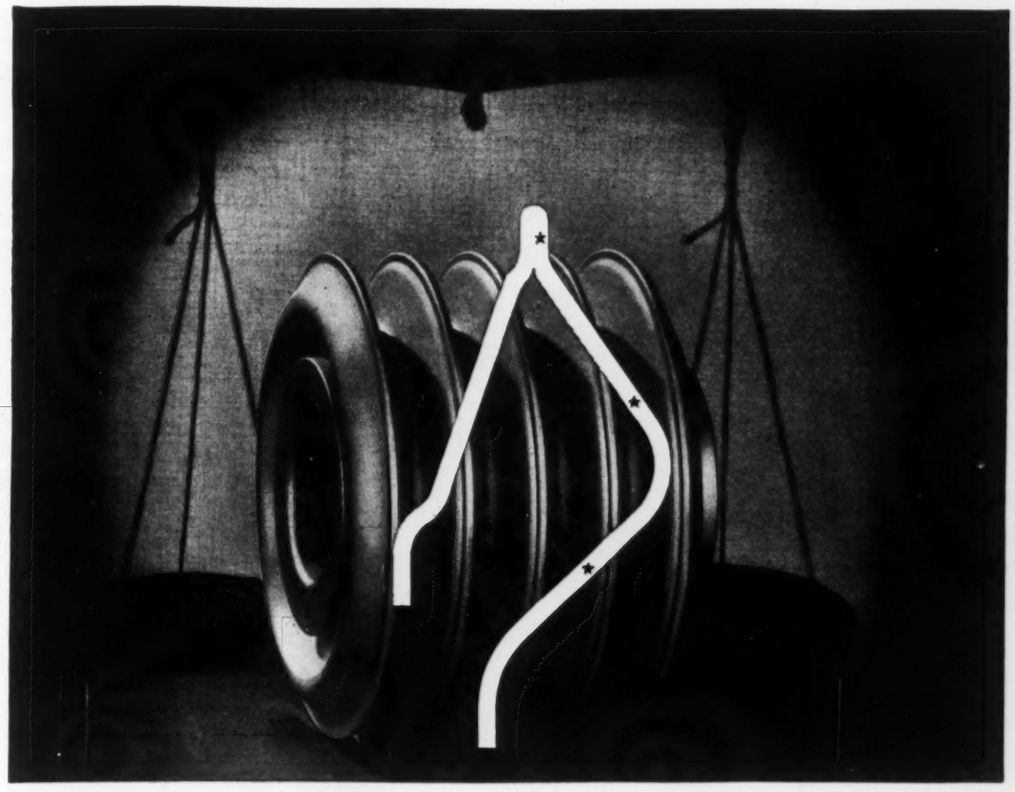
Pump and motor are built together as one unit with a single shaft

pump, shown herewith, is a single stage end-suction pump, and is applicable for circulating and cooling systems and for transferring and handling all reasonably clear industrial liquids.

Pump and motor are built together as one unit with a single shaft. The enclosed type impeller is keyed to the motor shaft which extends into the pump casing. There is only the one moving part. The shaft is of one piece, large diameter, heat-treated steel with a bronze sleeve where it passes through the stuffing box. Bronze wearing rings seal the impeller hubs against leakage, while the impeller itself is a one-piece bronze casting. This pump is furnished either with or without a water seal.

Part Creates Reciprocating Motion

AUTOMATIC translation of rotary motion into reciprocating motion is accomplished by the unique part being offered by S. Howes Co. Inc., Silver Creek, N. Y. In no sense is the part, shown herewith, an eccentric—its action is distinctly different. A vertical base plate carries standards which support two belt drums which are the only moving parts. Within these castings is a set of opposedly counterweighted, steel wheels connectedly geared to rotate vertically, each in an opposite direction. These machine-cut, heat treated rotor gears are offset axially. As they are synchronized, the counterweight of one neutralizes the counterweight of the other during two periods in each revolution, hence are produced one forward movement and a pause, then



BALANCE

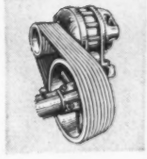
Accurately balanced drives eliminate vibration and the injury done to motors and driven machinery by vibration. • Duro-Brace Texsteel Sheaves, for Texrope V-Belt Drives, are fabricated from pressed steel of a uniform density throughout. The use of this material, in conjunction with the Allis-Chalmers method of manufacture, produces extreme accuracy of balance, both static and dynamic. • This accurate, vibration-eliminating balance is permanently preserved in Duro-Brace Texsteel Sheaves, for in this new design the outside walls are reinforced by convex steel plates which so greatly increase their strength as to eliminate distortion, even under the severest duty—thus giving a true running drive always. • Texrope Drives are 98.9% efficient, silent, slipless, vibrationless, shock-absorbing, require no lubrication or belt dressing, and are not affected by dirt or moisture. • Mail us a card asking for Bulletin No. 2188 which sets forth the advantages which Duro-Brace Texsteel Drives offer you in all matters of power transmission, whether they be simple or complex.

★★★

Former Design: cross-section showing unsupported outside plate.

New Duro-Brace Design: cross-section showing outside plate braced by a convex reinforcing steel plate.

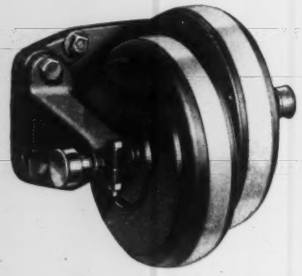
TEXROPE DRIVES



ORIGINATED BY ALLIS-CHALMERS MANUFACTURING

ALLIS-CHALMERS COMPANY • MILWAUKEE, WISCONSIN

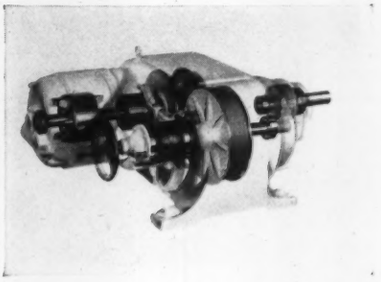
a reverse movement and a pause with each complete cycle of rotors. These rythmic motions transmit to the shoe a smooth to-and-fro movement without vibration or noise. While the transmission is revolving there is no outward sign of eccentricity; each drum follows its own path of rotation just like a pulley.



Unique part automatically translates rotary motion into even reciprocating motion

Variable Speed Drive Is Improved

A NEW lever arm construction, shown in the accompanying illustration, has been developed for the larger horsepower ratings of the Varidrive motor being manufactured by U. S. Electrical Mfg. Co., 1559 South Western Avenue, Chicago. In these motors a constant speed motor, a variable speed device and gear reduction have been built into a single compact unit. Speed change is obtained by varying the effective driving diameter of the disks which expand and contract for higher or lower speeds, transmitting power through the belt to the take-off shaft. The motor provides infinitely variable speeds to the driven machine, and can be directly connected to the machine.



Improved lever arm construction is adopted for infinitely variable speed unit

Switch Has Novel Interior

TYPE D thirty-ampere switches with a novel swing-out interior have been brought out in a new line by Switch & Panel division, Square D Co., Detroit. Base and operating mechanism of the switch, shown herewith, are mounted on

THE NAME TO REMEMBER
S.S.WHITE
THE PLACE TO GO

for anything and everything pertaining to

FLEXIBLE SHAFTS

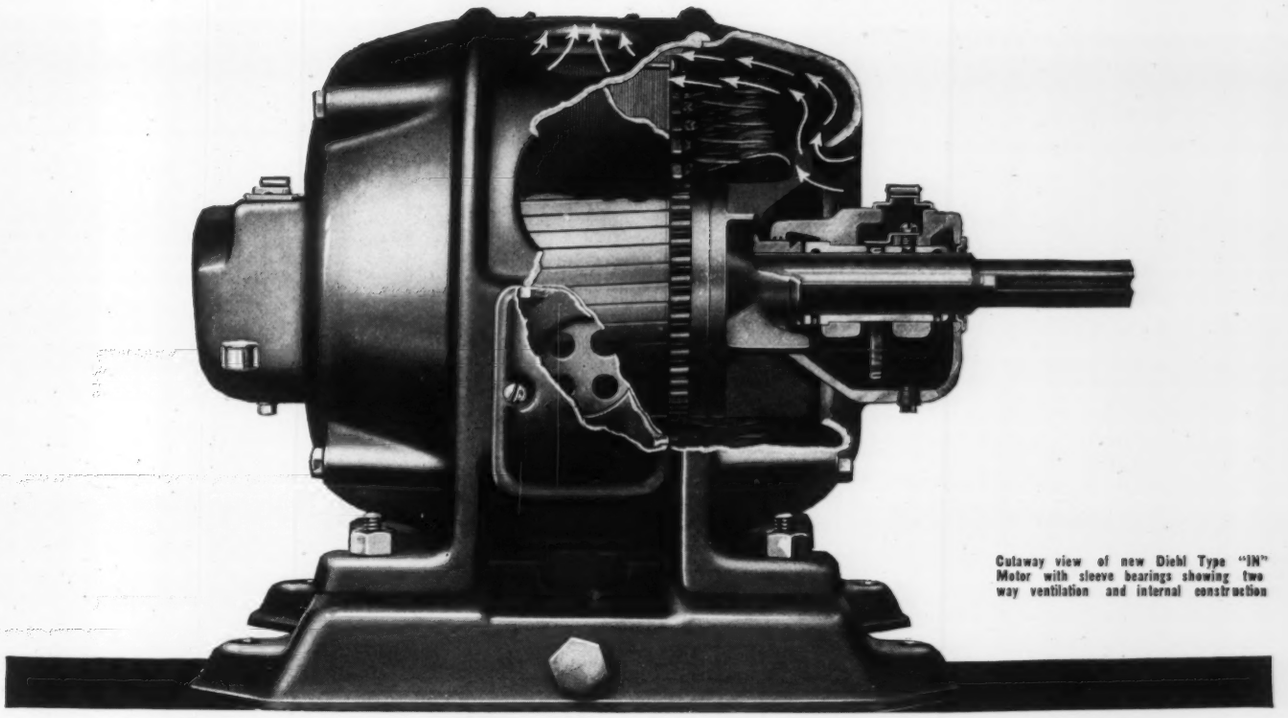
S. S. WHITE offers you the widest selection of flexible shafts available, for POWER DRIVE or REMOTE CONTROL applications. Also flexible casings, metallic and fabric, and end fittings for shafts and casings.

S. S. WHITE is your source of flexible shaft information and data. The fruits of over a half century of manufacturing, development and research are at your disposal.

S. S. WHITE is the place to go for engineering cooperation in working out flexible shaft applications or problems. The recommendations of our engineers are yours without obligation.

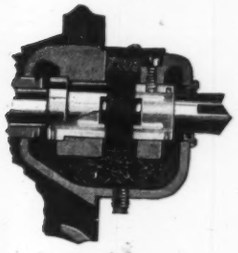
If you use flexible shaft apparatus of any kind, be sure it is equipped with S. S. WHITE Shafts. Their quality, dependability and long life guard against trouble and assure satisfactory performance.

The S. S. WHITE Dental Mfg. Co., INDUSTRIAL DIVISION
152-66 West 42nd Street, New York, N. Y.

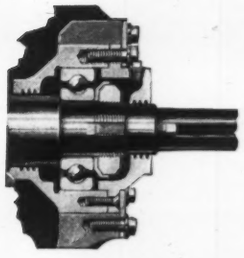


Cutaway view of new Diehl Type "IN" Motor with sleeve bearings showing two way ventilation and internal construction

IMPROVED VENTILATION GIVES LOWER OPERATING TEMPERATURES



Waste-packed bearing.



Cartridge type ball bearing

Two special rotor fans shrunk on shaft . . . smooth flowing air streams . . . unrestricted intakes and outlets . . . and smooth glass-like windings give Diehl "IN" motors a ventilating system that provides unusually efficient cooling and is not likely to become clogged by dirt, dust and other flyings.

Forty-one important features make "IN" squirrel-cage motors ideal for machine tools, pumps, blowers, hoists, conveyors and hundreds of other industrial applications.

High starting torque, super-insulation, quiet operation, long life and low maintenance are built into these motors. Dimensions are N. E. M. A. standard. Motors with special shafts, bearings and mountings can be furnished quickly. Diehl service stations are nationwide and Diehl Engineers will gladly give you the benefit of their half-century experience in serving leading manufacturers and industrial plants.

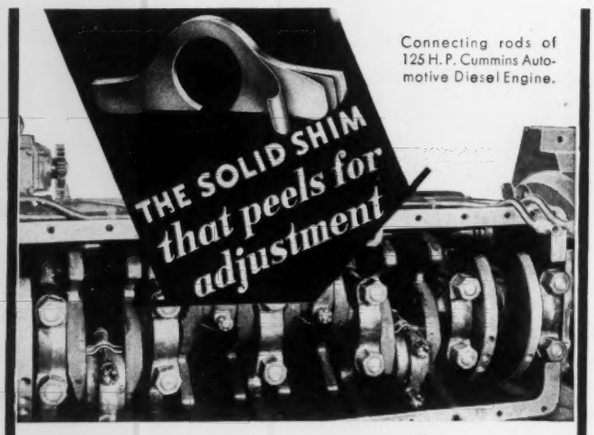
Bulletins covering practically all standard Diehl motors from the smallest fractional sizes up to 50 HP. A. C. or D. C., are available on request.

Write to Diehl Manufacturing Company, Elizabethport, New Jersey, or to Offices in Atlanta, Boston, Chicago, Dallas, New York and Philadelphia.

DIEHL MOTORS

DIEHL MANUFACTURING COMPANY, Electrical Division of THE SINGER MANUFACTURING COMPANY

855



Connecting rods of 125 H.P. Cummins Automotive Diesel Engine.

● providing more accurate adjustment for connecting rod bearings

QUICK, ACCURATE service adjustment is provided by installing Laminum shims in these Cummins Engine connecting rod bearings. You simply *peel off* the .002" brass laminations to obtain the precise adjustment required. No filing . . . No miking!

LAMINUM

LAMINATED SHIM COMPANY, INC.
2126 Forty-fourth Ave., Long Island City, N. Y.

544

Flexible in Application

. . . . Saves expensive power take-off
. . . Horizontal or vertical mounting
. . Compact — Self-contained
. Powerful — Efficient

BROWN & SHARPE GEARED MOTORPUMPS

3 sizes — May we send specifications?

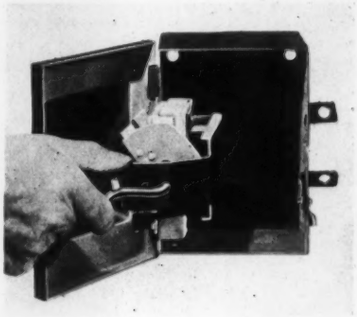
Brown & Sharpe Mfg. Co., Providence, R. I.

Horizontal Mounting

B·S

Brown & Sharpe Pumps
Geared — Vane — Centrifugal

a metal supporting plate which is hinged to the side of the box. The entire interior may be swung out away from the box by a pull on the operating handle, thus leaving the entire box



The entire interior of new switch may be swung away from the box by a pull on the operating handle

area open for unobstructed wiring and conduit connections. The hinged interior is self-aligning when swung back into position.

Blueprinter Operation Is Simple

BLUEPRINT machines which utilize the new Angstrom blueprint lamp have been placed on the market by Milligan & Wright Co., 4615 Prospect avenue, Cleveland. The Angstrom lamp used in this machine is of the incandescent type. It operates from the regular 110-115 direct or alternating current lighting circuit without the need for transformer choke coils or similar equipment. The lamp differs from the ordinary incandescent lamp in the quality of light produced, being stronger in the blue end of the spectrum.

The model 100 machine, shown herewith, is

Special incandescent lamp in blueprinter is run from the ordinary lighting circuit

the portable table type which will print one 18 by 24 or two 12 by 18 or four 9 by 12 prints at one time. To make a print it is only necessary to place the tracing and paper on the plate glass top, lower the pressure pad and close the cover. The springs in the cover act on the pressure pad to assure good contact between tracing and paper. An automatic time switch is set for the time of exposure.

WELDING Design Simplifies Assembly

• Oxwelding proved to be the only practicable way to fabricate these turbine-type mixers. The welding blowpipe eliminates cumbersome mechanical fabrication; assures fast production with smooth, strong joints; and each curved blade is easily joined to the central shaft and outer brace. On the smallest mixer, for fine material, there are 72 in. of welding; on the largest, for coarse material, welded seams total 22 ft.

A MANUFACTURER had an order for a number of small turbines to be used for mixing delicate face powders. The turbine blades had to have smooth curves and joints to obtain the required fineness in the finished product. What looked like a tough production problem became simple when welding was adopted.

LINDE PROCESS SERVICE HELPED

In working out the unusual problems involved, the manufacturer utilized the wider welding experience of Linde Process Service. Linde cooperated in the selection of welding materials, in training the operators of welding equipment, and in organizing the welding production for speed, dependability and profit.

This service is available to you also, if you are a Linde customer. It brings to you the best methods developed through Linde's vast and intimate association with the welding practices, and the extensive research and engineering facilities of other units of Union Carbide and Carbon Corporation.

WRITE THE NEAREST LINDE OFFICE

If you have a problem of product design or redesign, the nearest Linde Sales Office will be glad to cooperate. These are located in Atlanta—Baltimore, Birmingham, Boston, Buffalo, Butte—Chicago, Cleveland—Dallas, Denver, Detroit—El Paso—Houston—Indianapolis—Kansas City—Los Angeles—Memphis, Milwaukee, Minneapolis—New Orleans, New York—Philadelphia, Phoenix, Pittsburgh, Portland, Ore.—St. Louis, Salt Lake City, San Francisco, Seattle, Spokane and Tulsa.

Everything for oxy-acetylene welding and cutting—including Linde Oxygen, Prest-O-Lite Acetylene, Union Carbide and Oxweld Apparatus and Supplies—is available from Linde through producing plants and warehouse stocks in all industrial centers.

The Linde Air Products Company

Unit of Union Carbide and Carbon Corporation

UCC

In Canada: Dominion Oxygen Co., Ltd. Toronto

In 1935

STEP UP PLANT EFFICIENCY

STEP DOWN PUMPING COSTS

with VIKING Rotary PUMPS

If you are looking for GREATER PLANT EFFICIENCY and LOWER PUMPING COSTS in 1935 . . . the VIKING ROTARY PUMP is what you are looking for.

The Viking has "JUST TWO MOVING PARTS"... "A GEAR WITHIN A GEAR." That means less wear . . . fewer repairs . . . lower power requirements . . . longer life.

Merely tell us your pumping problem. Our Engineering Staff will gladly recommend the proper capacity and model to handle the job at the "Lowest Per Gallon" cost to you.

Viking Pump Company

Cedar Falls, Iowa

Now- MAKE BLACK AND WHITE PRINTS FASTER THAN BLUE PRINTS . . . .

Amazingly simple new process develops black line prints from paper or cloth exposed in your blueprinting machine ...no negative, no washing or drying. BLACK AND WHITE Prints are easier to read and check...easier to make notes on...have much wider usefulness than blue prints. Thousands of firms now use them. Mail coupon for facts.

Free Booklet

CHARLES BRUNING COMPANY, Inc.
102 Reade Street, New York, N. Y.
Send me, without obligation, your FREE booklet, "Black and White Magic."

Name_____

Address_____

City_____ State_____ 522

BRUNING

SINCE 1899

MEN OF MACHINES

(*Concluded from Page* 45)

built a new series of engines ranging from 75 to 1500 horsepower for Bessemer Gas Engine Co. When this organization was merged with the Cooper company he became assistant chief engineer.

To readers of MACHINE DESIGN Mr. Shepherd's authoritative articles on a variety of subjects disclose his broad vision. Further evidence of his knowledge of the engineering field is best revealed by his new book, "*Diesel Engine Design*," discussed on page 23.

* * *

A. BAIR BASSOFF, recently appointed executive engineer of the S-B Gear Corp., will have complete charge of development, design and production of that company's products. In addition, he will continue his connection as consulting engieer of Sier-Bath Co.

* * *

HARRY P. CHARLESWORTH has been elected chairman of the board of the Engineering Foundation to fill the unexpired portion of terms ending Feb. 31, 1935. He is assistant chief engineer of American Telephone & Telegraph Co.

* * *

PROF. WILLIAM CAMPBELL, after serving twenty-five years as chairman of the A.S.T.M. committee B-2 on nonferrous metals and alloys, has been honored by election to the office of honorary chairman.

* * *

COL. C. H. CRAWFORD has been selected to represent the four Founder Societies in an effort to aid the federal government in obtaining qualified men for engineering work. He will be located in Washington.

* * *

A. C. FIELDNER is the newly elected vice president of the American Society for Testing Materials. In 1931 he received the Lamme medal for meritorious accomplishment in engineering.

* * *

J. R. TOWNSEND, general development laboratory, Bell Telephone Laboratories Inc., has been made chairman of committee 6-B on die cast metals and alloys of the American Society for Testing Materials.

* * *

HOWARD COONLEY, president, Walworth Co., recently was re-elected president of the American Standards association for 1935. FREDERICK E. MOSKOVICS was re-elected vice president; J. C. IRWIN and F. M. FARMER were re-elected chairman and vice chairman, respectively, of the standards council.

* * *

E. J. STIRNIMAN has been appointed to represent the Catepillar Tractor Co. in Australia and New Zealand. After graduating in agricultural engineering from Iowa State college he became a member of the agricultural engineering staff of the State College of Washington and later was a partner of the Pullman Engineering Co. Subsequently he joined the agricultural engineering staff of the University of California.

$40,000.00...

TO SAVE 2 MINUTES

Chicago recently installed a new traffic control system on Michigan Boulevard. It replaced a system only six years old. The change cost $40,000.00 and saves but 2 minutes in driving a little more than 2 miles.

$40,000.00 to save *only* two minutes? Yes, but 2 minutes for *each* of more than 100,000 people who travel that stretch every day.

That is why *control* is always so important. Cutler-Hammer Motor Control might save only a fraction of a second in a machine operation compared with ordinary Motor Control. But it does it for thousands of operations per day, each week, each month, for years.

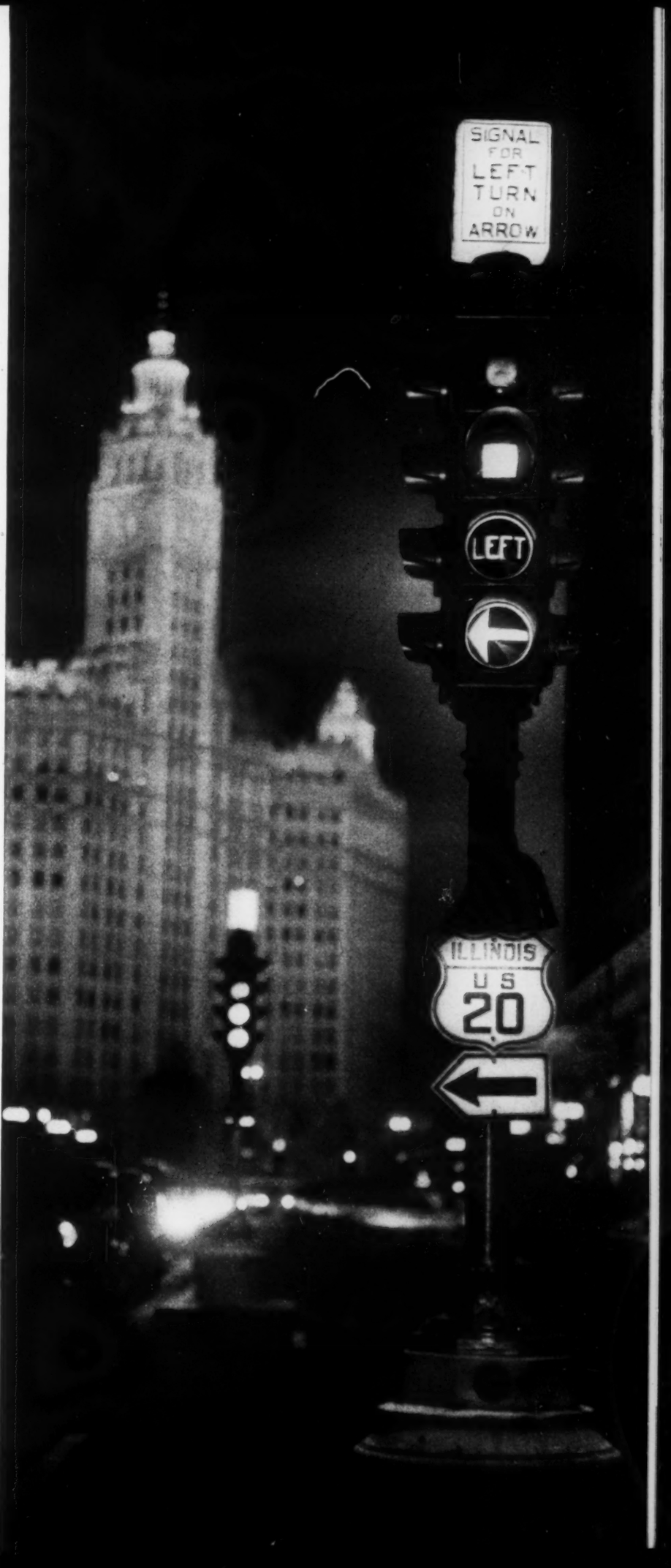
It's just plain foolish to disregard the savings good Motor Control offers. Cutler-Hammer costs no more to buy but saves so much more in service. Why don't you, too, specify Cutler-Hammer for every motor drive? CUTLER-HAMMER, Inc., *Pioneer Manufacturers of Electric Control Apparatus*, 1310 St. Paul Avenue, Milwaukee, Wis.

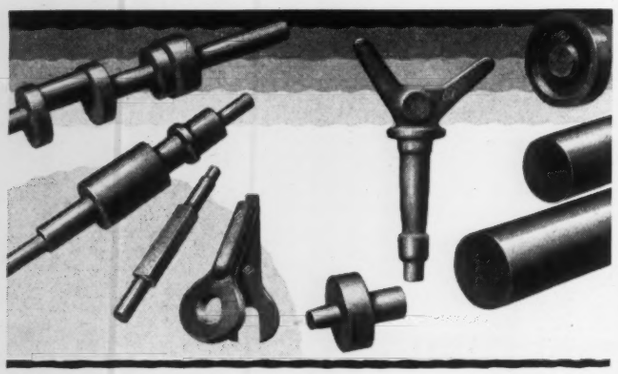
C-H

CUTLER-HAMMER MOTOR CONTROL

To Machine Designers

See February FORTUNE and February 11 TIME for this advertisement, the second of the 1935 national magazine series on Cutler-Hammer Motor Control. More widely advertised than any other, Cutler-Hammer Control definitely improves the saleability as well as the performance of the machines it completes.





FORGINGS . . . Thirteen steam hammers and ten drop hammers, the largest battery in the middle west, are available for making drop forgings in sizes to 700 pounds and hammered forgings to 30 tons. Any size, any shape, any quantity.

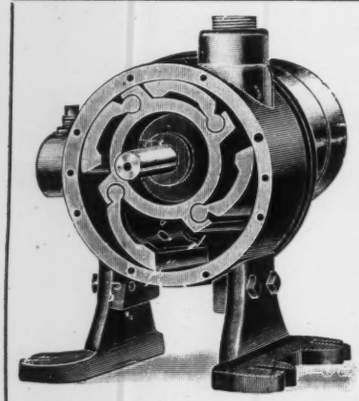
HEAT TREATING . . . Six heat treating furnaces ranging from a small box type unit to the longest heat treating furnace on batch work are available for heat treating forged parts to your most exacting specification.

MACHINING . . . A modern, well equipped machine shop provides for full or rough finishing of forged parts where machine work is required. Here, too, are made the dies for drop forge work, centering in our organization full responsibility for the production of "exact dimension forgings."

If it's forged—send blue prints with request for quotation to Kropp!

KROPP FORGE COMPANY
5309 W. Roosevelt Road, Chicago

"forgings to your specification"



PUT THIS AIR PUMP ON YOUR MACHINE FOR

Aerating
Agitating
Singeing
Branding
Preheating
Assaying
Brazing
Annealing
Soldering
Forging
Hardening
Oil Furnaces
Gas Furnaces
Coal Furnaces
Suction Chucks
Vacuum Cleaning
Solder Iron Heaters
Wrapping Machines
Massaging Machines
Laboratory Work
Blow Lamps
Blow Pipes
Glass Blowing
Gas Pumping
Testing Meters
Pressing Irons
Calliopes
Milking Machines
Steam Heating Systems
Paper Feeding Devices
Printing Presses
Mailing Machines
Testing Gas Fittings
Removing Foul Air
Supplying Fresh Air
Melting

THEY TAKE UP THEIR OWN WEAR!

LEIMAN BROS. PATENTED ROTARY POSITIVE AIR PUMPS

23 Walker St. New York — LEIMAN BROS., INC. — 156 Christie St. Newark, N. J.

Makers of Good Machinery for 45 Years

Predesign Survey Indicates Mixer Essentials

(*Concluded from Page* 32)

when the solid caught between the beater blades and the wall of the bowl. For this reason the mixer post shown was adopted. The blades now are of monel metal fastened at the bottom of the post and through a spring action held against the outer sides of the slots *K*, *Fig.* 5. If a solid object is dropped into the bowl the blades will give, thus obviating stalling or possible damage.

Dead Spots Are Eliminated

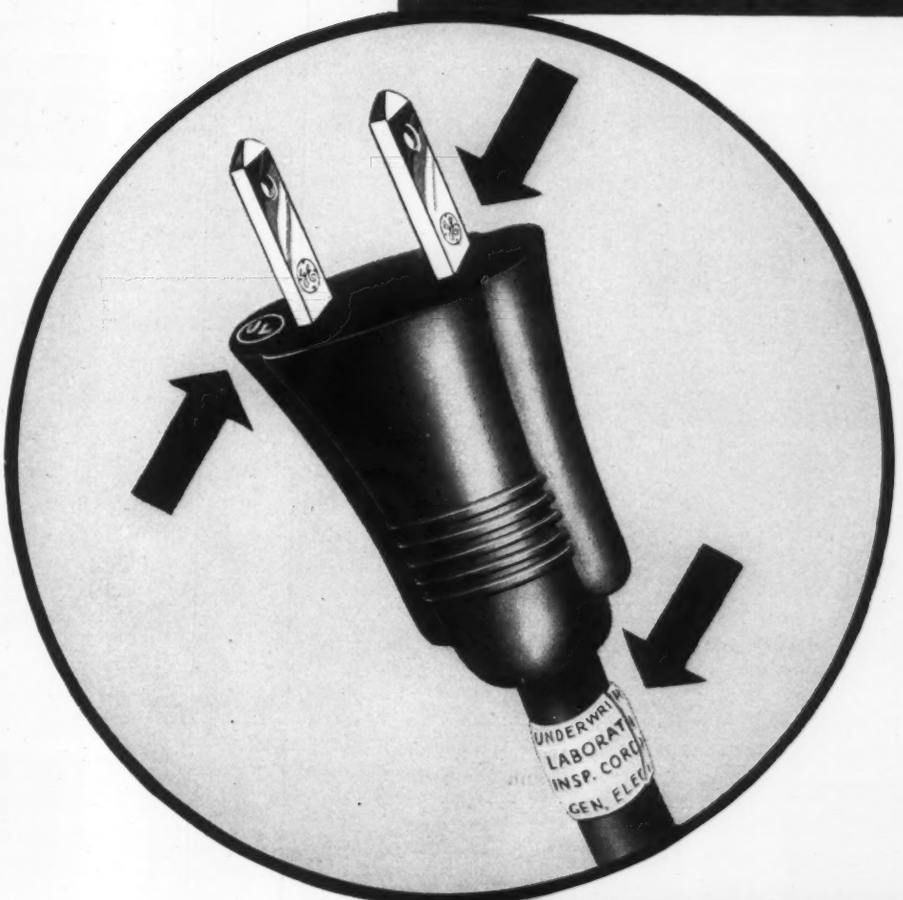
Two of the major requirements set up for this design were that there be no "dead spot" in the bowl, and that the time necessary for mixing be short. Time needed for mixing is kept at a minimum by the use of two beaters in the beater assembly. Dead spots are eliminated by the design of the bowl shown in *Fig.* 6. The shaft rises through the center of this bowl while the beaters fit into the annular space with just enough clearance to allow operation thus there can be no section of the bowl where the mixing is not thorough. Bowls used with the first designs were of cast aluminum, but these bowls were a trifle heavier than was desired and they were hard to polish. Therefore an assembly of an aluminum stamping and an aluminum tube as shown in *Fig.* 6 was adopted. The tubing is crimped at *A* to hold the stamping, while the raised portion of the tubing, *B*, rides on the lugs *O* in *Fig.* 1, thus allowing the bowl to rest firmly in position, yet also allowing it to turn freely around the shaft. Any substance in the bowl will pull it around when the beaters are rotating about the center and when the bowl is in an unlocked position.

Anodic Coating Employed

Resistance of the metal in the bowl to acids is insured by an anodic aluminum coating on the interior which gives ample protection and yet is decorative enough to provide an attractive finish.

As slicing and shredding is done by electrotinned, stamped steel plates rotating in a flat plane, possibility of accident is greatly reduced over the possibility of catching the fingers in a slicer of involute shape where, once caught, the fingers would be drawn further into the machine. Ease of assembly is enhanced in the grinder and chopper by designing the parts with either side the "right side" so that there is no possibility of getting the parts together in any way except the right way.

NEW STYLE AND BEAUTY TO HARMONIZE WITH YOUR PRODUCT



These three marks of quality are your assurance of customer satisfaction.

The new Underwriters' Laboratories mark of approval appears on every General Electric Rubber Plug.

This familiar bracelet-label identifies the cord as listed by Underwriters' Laboratories, Inc.

The symbol of dependability.

THE MODERNE NO. 30

Every General Electric All-rubber Plug is moulded on the cord . . . not simply attached, assuring utmost safety and reliability. Write for complete information and samples to Section Q-322, Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

ACCESSORY EQUIPMENT

MERCHANDISE DEPARTMENT, GENERAL ELECTRIC COMPANY, BRIDGEPORT, CONNECTICUT

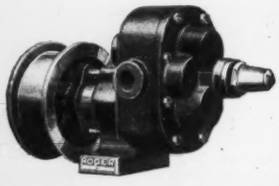
THE HEART OF POWER

LIFE BLOOD *for* MACHINE TOOLS

Roper Rotary Coolant Pumps sustain life in Machine Tools by supplying the "Life Blood" to cutting edges. Always on the job, they cause no costly delays for the machine to which they are attached.

All types for handling cutting compounds and lubricating fluids. Non-pulsating . . . force to reach deepest cuts and bores . . . guaranteed not to lose prime . . . high or low pressure.

Write for Bulletin No. R-4-MD



ROPER

Dependable PUMPS *Since 1857*

GEO. D. ROPER CORP., ROCKFORD, ILL.

Synchronous Motors

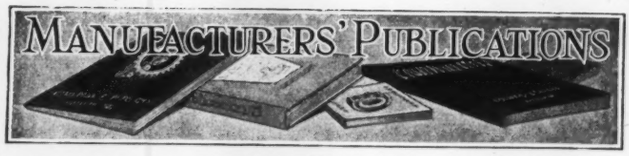
Holtzer-Cabot Synchronous Motors for Operating Automatic Recording and Control Devices.

The modern industrial recording and controlling instrument is very often the nerve center directing and recording a complicated industrial process. These instruments must operate with precision and perfect synchronism.

For more than 20 years Holtzer-Cabot Synchronous Motors have been the discriminating choice of the leading instrument manufacturers.

Our engineers will gladly confer with you. Their experience can be helpful—write Dept. 14 for descriptive bulletin.

THE HOLTZER-CABOT ELECTRIC Co.
125 AMORY STREET, BOSTON, MASS.
Motor Specialists for 50 Years



BIMETAL—A new handbook on Truflex thermostatic bimetal has been published by General Plate Co., Attleboro, Mass. All the facts about the types of bimetal manufactured by the company are summed up and presented in usuable form in the handbook, which includes charts for calculating the proper elements and suggestions on how bimetal may be used.

COMBUSTION EQUIPMENT—Oil burner units which can be built into the design of machinery are described and illustrated in a bulletin of Philadelphia Drying Machinery Co., Philadelphia. The bulletin includes combustion data.

CONTROLS (ELECTRICAL)—Struthers Dunn, Inc., Philadelphia, has prepared a folder, bulletin P72, which gives a brief description of the company's line of relays, timing devices, electric counters, thermostats, etc.

CONTROLS (ELECTRICAL)—Rheostats for electroplating processes which incorporate close current regulation, compact construction and simplicity of operation are described in a recent bulletin of Udylite Co., Detroit.

DRIVES—Worthington Pump & Machinery Corp., Harrison, N. J., has prepared an attractive folder on its multi-V-drive. The bulletin gives the advantages of the drive and details of the construction of the belts.

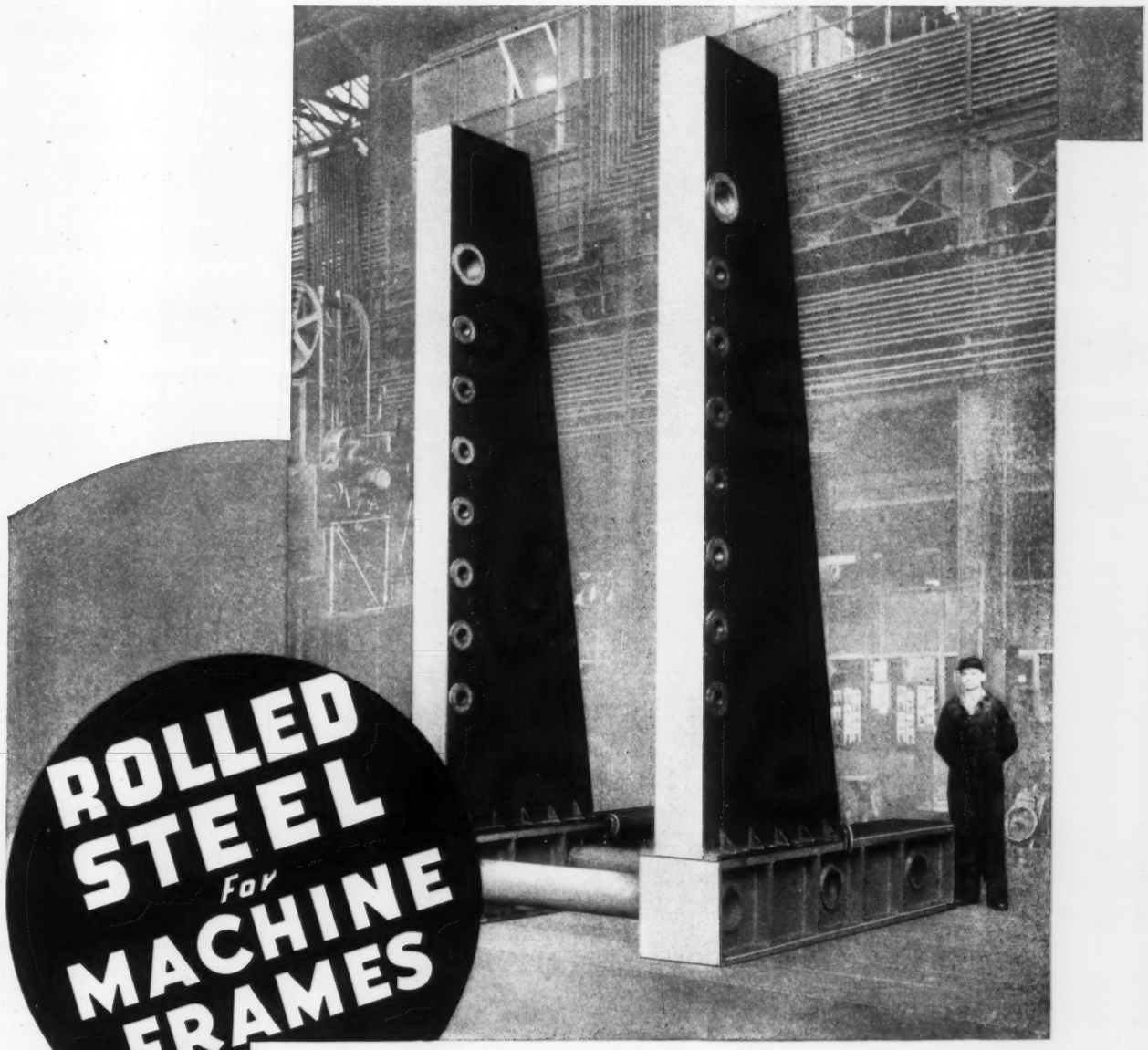
DRIVES—U. S. Electrical Mfg. Co., Chicago, has prepared a bulletin on a new development in the design of its Varidrive motor, a unit consisting of motor, variable speed device and gears combined in a single case for providing infinitely variable speeds to the machine.

DRIVES—Single parallel geared-head motors in ratios up to 6:1 and double parallel geared-head motors in ratios from 6:1 to 36:1 are presented in two new bulletins of Master Electric Co., Dayton, O. The well-prepared bulletins contain a description of the drives and complete tables of ratios and speed, overhung loads and limiting horsepower.

FINISHES—Complete data on the electrical properties, compatibility, dilution and other characteristics of Tornesit, a new chlorinated rubber base for formulating paints, emulsions, binders, adhesives and plastics having a high chemical resistance are included in a recent publication of Hercules Powder Co., Wilmington, Del. The material will resist both acids and alkalies at the same time.

HYDRAULIC EQUIPMENT—Hydraulic units for operation of machines, available in three sizes, are announced in the December issue of *Tool Tips* published by Ex-Cell-O Aircraft & Tool Corp., Detroit.

INSTRUMENTS—Photoelectrically balanced recorders, photoelectric controllers and light-beam indicators are completely described and illustrated in bulletin No. 1101 of C. J. Tagliabue Mfg. Co., Brooklyn, N. Y. The bulletin



ROLLED STEEL *For* MACHINE FRAMES

WHEN you use rolled steel for machine frames, you always have just the weight and strength you need, without excess.

Whether it's a frame welded up from ½-in. plates or from 6-in. plates, it can be designed solely to meet the requirements of the product itself... without costly concessions to production limitations.

Often the adoption of rolled steel eliminates many items of expense, reduces the amount of machining required, reduces weight by employing heavy construction only where it is needed to meet heavy stresses.

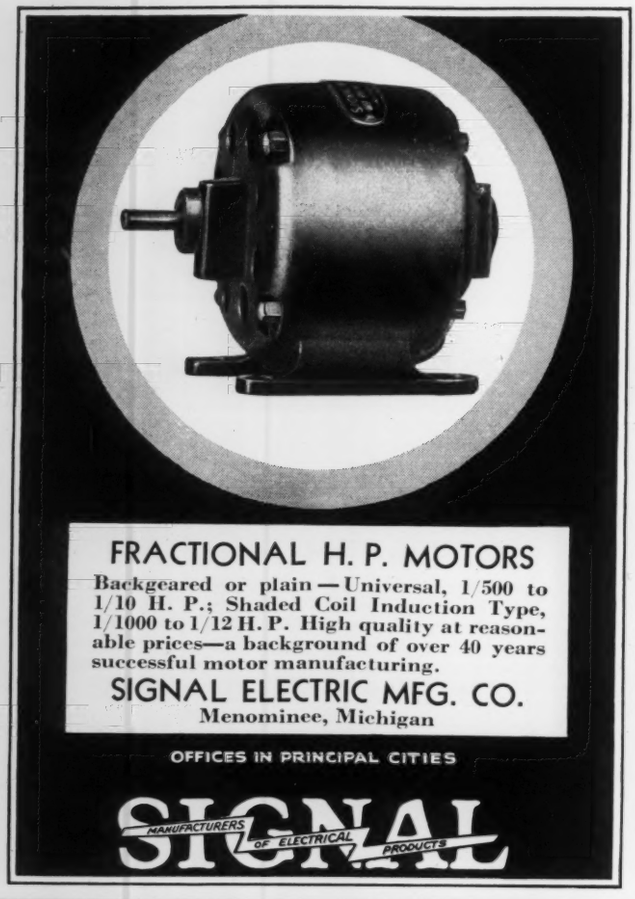
ROLLED STEEL OFFERS THESE ADVANTAGES

1. Cheaper . . . for most parts.
2. Reduces loss due to defects or discards.
3. Permits inexpensive changes in design.
4. Faster production . . . particularly of new and unstandardized parts.
5. Reduces inventory and pattern storage.
6. Permits prompt adaptation of standard design to special requirements.
7. Eliminates excess weight.
8. Modernizes appearance.

ILLINOIS STEEL COMPANY

208 SOUTH LA SALLE STREET, CHICAGO, ILLINOIS

United States Steel Corporation Subsidiary



FRACTIONAL H. P. MOTORS

Backgeared or plain — Universal, 1/500 to 1/10 H. P.; Shaded Coil Induction Type, 1/1000 to 1/12 H. P. High quality at reasonable prices—a background of over 40 years successful motor manufacturing.

SIGNAL ELECTRIC MFG. CO.
Menominee, Michigan

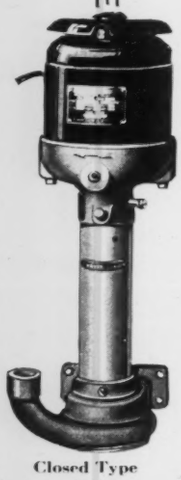
OFFICES IN PRINCIPAL CITIES

SIGNAL
MANUFACTURERS OF ELECTRICAL PRODUCTS

When You Require Coolant Pumps . . . .

Specify —

"BROWNIE"



Closed Type

A pump which has no packings to leak. No screens to clog. A pump which is entirely self-aligning. "Open" types (for setting on bottom of tank) and "Closed" types (for mounting on outside of tank) 10-100 G.P.M. A pump which handles anything from coolant, impregnated with grit and chips, to oil.

Write for Bulletin No. 10

The TOMKINS-JOHNSON Co.
618 N. MECHANIC ST.
JACKSON, MICHIGAN

not only gives engineering data on the instruments, but it also includes a detailed description of the parts used and their action.

MOTORS—Master Electric Co., Dayton, O., has prepared an attractive bulletin known as Data 515 on its line of single phase, repulsion start induction motors. The bulletin gives complete details of the design, including both descriptive matter and cutaway photographs.

RUBBER—A new book of engineering data, designed to simplify the selection of belting, hose and other mechanical rubber goods for industrial service, has been compiled by B. F. Goodrich Co., Akron, O. The book contains 21 pages of information and describes over 200 rubber items.

TIMERS—Automatic timing, as used in a variety of machines, is covered in a new bulletin of Walser Automatic Timer Co., New York, which gives complete data on the company's large line of clock-operated electrical timing devices which can be built into the design of machinery.

TUBING—Summerill Tubing Co., Bridgeport, Pa., has prepared a folder on its tubing specialties for use in aircraft, industrial control equipment, oil and diesel engines, heat transfer and refrigeration.

Research Publications

Effect of Cold-Rolling on the Indentation Hardness of Copper. In an investigation in which tough-pitch electrolytic copper, oxygen-free copper and large single crystals of copper were subjected to severe cold rolling it was found that the indentation hardness increased with successive reductions rapidly at first, until a maximum hardness was reached. The maximum hardness was maintained there after during further reduction until the hardness determinations became unreliable owing to the thinness of the specimens. Irregularities in the hardness-reduction relation were encountered only in the case of very thin specimens. Similar results were obtained for the change in tensile strength with increasing reduction. The change in mechanical properties, as a result of severe cold rolling, was not appreciably affected by the initial thickness of the specimen, the oxygen content of the copper, the change from polycrystalline to single-crystal material, or the orientation of the single-crystal specimens with respect to the plane of deformation. Published as RP742 by National Bureau of Standards. Available through Superintendent of Documents, Government Printing office, Washington.

Report of an Inquiry into Changes in Quality Values of Farm Machines between 1910-14 *and* 1932, prepared by J. B. Davidson, G. W. McCuen and R. U. Blasingame. Changes in the design, material or construction of a farm machine, or any part thereof, may add to its quality value in a number of ways. The authors of this report list and describe these ways, include a chronological record of improvements in 25 farm machines, present the materials used, and give a pictorial record accompanied by descriptions of changes in typical farm machines and component parts. Available from American Society of Agricultural Engineers, Saint Joseph, Mich. 165 pp. 50 cents.

Business and Sales Briefs

ALLIS-CHALMERS MFG. CO., Milwaukee, has opened a district sales office at 1609 Merchants Bank building, Indianapolis, taking over some territory from the Chicago office. The office, which will be in charge of Harry C. Crawford, will cover two-thirds of Indiana and western Kentucky, including Louisville.

* * *

J. R. Schuchardt has been appointed sales engineer in the metropolitan district of New York for Advance Pressure Castings Inc., Brooklyn, N. Y.

* * *

C. H. H. Weikel has been appointed manager of the commercial research and industrial development department of Bethlehem Steel Co., Bethlehem, Pa.

* * *

Timken Steel & Tube Co., Canton, O., and Aluminum Co. of America, Pittsburgh, have been licensed to manufacture tubing under the patent of Tube Reducing Corp., 292 Madison avenue, New York.

* * *

Ralph H. Clore has been named general sales manager of Medart Co., St. Louis, succeeding F. P. Kohlbry who has resigned to asume active charge of Machinery & Welder Corp., Chicago. Mr. Clore was formerly general sales manager of United States Electrical Tool Co., Chicago.

* * *

The Carl E. Swift Corp., of Holland, Mich., has been organized to manufacture electric washing machines and other appliances. Officers of the corporation are Carl E. Swift, president, E. G. Landwehr, vice president and treasurer, Henry I. Stimson, secretary, and Frank E. Stearns, works manager.

* * *

Harry L. Barr has been appointed to take charge of the electrical sheet sales division of Granite City Steel Co. Mr. Barr has been identified with the sale or manufacture of this product for the past 20 years. His previous connections were with Newton Steel Co. and Follansbee Bros.

* * *

Foote Bros. Gear & Machine Co., Chicago, has announced the appointment of C. A. Hayward as sales and engineering representative for speed reducers and gearing in the Detroit-Michigan territory. Mr. Hayward's headquarters will be in the Stormfeltz Lovely building, 7310 Woodward avenue, Detroit

* * *

Belden Mfg. Co., Chicago, has opened a new branch and soft rubber plug assembly division in the New Terminal Commerce building, 401 North Broad street, Philadelphia. Complete stocks of magnet wire wil be carried by the branch. E. V. Blake, for eight years connected with the company as territorial representative and sales service manager, will be in charge of the branch as eastern manager.

* * *

R. M. Spurck, formerly assistant manager of the switchgear engineering department of General Electric Co., has been named manager of sales of the circuit breaker section of the switchgear sales division of the company at Philadelphia. H. E. Starbuck, formerly manager of sales of the circuit breaker section, has been appointed general assistant in the switchgear sales division and will give particular attention to field problems involved in switchgear sales activities.

—*Cross Sections*—

AUTOMOBILE designs introduced last year and this have educated the public to such an extent that there is practically no market for any car that is not streamlined to a considerable degree. Yet who remembers the old Kissel, perfectly streamlined many years ago, which appeared much as today's cars yet was so far ahead of the trend that lack of sales caused its discontinuance?

MACHINE tool gray, long the standard finish, is fast losing ground. Natural metal finishes, cadmium and chromium, crinkle finishes, flexible aluminum paints, and paints of all colors are taking over the field. We're all for this worth-while improvement in appearance, but it's a good thing for our blood pressure that we haven't seen any baby blue machines in the shops.

THE OTHER day we had cause to refer to our copy of *Mechanical Power Transmission from Motor Drive to Industry* and were again impressed with the comprehensive manner in which Drake has covered his subject. To many people the book will seem to favor one type of drive, but leaving out the discussion of competitive types, (which by the way includes a number of points worthy of consideration), the book gives engineering data of interest to the designer as well as the plant man.

ORDERS for back copies of MACHINE DESIGN are constantly being received, and we are glad to fill them whenever possible, but have you noted that the great majority of articles are so arranged that you can clip them out for your files without destroying other articles? Would you be interested in a classified file number that would be printed on the upper right hand corner of the leading pages of articles to asist you in the filing?

FOLLOWERS of our series of articles on patents will probably be interested in a little problem. An inventor patented a means of driving a tube into the earth until it reached the water level to form an artesian well. The claim was: "What I claim as my invention, is: The process of constructing wells by driving or forcing an instrument into the ground until it is projected into the water, without removing the earth upward, as it is in boring, substantially as herein described." Tell us how you would design around this claim. It can, and has, been done.

EVERYONE is familiar with the safety guaranteed by push button stations so built that the stop button completely surrounds the start button and is higher than the start button. A slap with the flat of the hand will stop the machine. However, if a man's clothing or hand is caught in the machine, it might require some maneuvering to be in position to slap the switch. Safety is even further enhanced by a pendant-type push button station seen on equipment in the shops of one of the largest electrical manufacturers. All that is required is to hit the switch with the shoulder or head, or can even kick it if you're agile enough, and the machine will stop.